ABSTRACTS OF NORTH AMERICAN GEOLOGY

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UNITED STATES DEPARTMENT OF THE INTERIOR

WALTER J. HICKEL, *Secretary*

GEOLOGICAL SURVEY

William T. Pecora, *Director*

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ABSTRACTS OF NORTH AMERICAN GEOLOGY

INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with small circulation (such as dissertations, open-file reports of memorandums) or of other papers presented orally at meetings.

The Abstracts is an additional reference tool but does not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology are published each year. The Bibliography includes citations and subject index for a calendar year.

The numbers assigned to the abstracts in this publication are for reference in using the index; they are not order numbers. Publications cited here in abstract form are available in most geological libraries or through interlibrary loan.

Abstracts of North American Geology and the Bibliography are prepared by use of computer techniques. Each abstract, along with its indexing, is placed on magnetic tape and entered into a permanent data bank. The material prepared each month is published in the form of the present issue. The abstracts are arranged alphabetically according to senior author. A subject index follows the abstracts and is designed for rapid reference to any subject desired. Bibliographies can subsequently be retrieved according to the terms used in the index.

A list of journals commonly cited in Abstracts of North American Geology may be obtained by writing to the U.S. Geological Survey, Washington, D. C. 20242. Serial publications cited for the first time are as follows:

Analyst—The Analyst. The journal of the Society for Analytical Chemistry. The Chemical Society. Letchworth, Herts., England.

Inst. Mexicano Petróleo Rev.—Revista del Instituto Mexicano del Petróleo. Mexico, D. F., Mexico.

Kgl. Danske Vidensk. Selsk. Oversigt—Det Kongelige Danske Videnskabernes Selskab Oversigt Selskabets Virksomhed. Munksgaard. Copenhagen, Denmark.

Pennsylvania Geology—Pennsylvania Geology. Topographic and Geologic Survey. Harrisburg, Pa.

Tunnels and Tunneling—Tunnels and Tunneling. Milton Publications Ltd. London, England.

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ABSTRACTS

08683 **Acosta Ojinaga, R.** Interpretación de secciones sismológicas regionales en la Franja de Calizas de la Cuenca de Veracruz [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 86, 1969.

Addison, Charles H. *See* Sweeney, James W. 08510

08844 **Ahnert, Frank.** Functional relationships between denudation, relief, and uplift in large, mid-latitude drainage basins: Am. Jour. Sci., v. 268, no. 3, p. 243-263, illus., tables, 1970.

The mean denudation rate in mid-latitude river basins is directly proportional to mean basin relief. Mean annual precipitation has no noticeable effect upon the denudation rate. Without any uplift, the relief is reduced to 10 percent of its initial value in 11 m.y.; with isostatic compensation this time increases to at least 18.5 m.y. Establishment of a steady state relief (Hack, 1960) would require a constant rate of uplift for more than 20 m.y. and thus is unlikely to occur. Oscillating rates of uplift cause corresponding oscillations of relief. The quantitative relationship between uplift, relief, and denudation may permit order-of-magnitude estimates of current rates of uplift. — Author's abstract

Allen, David. *See* Norton, Norman J. 01093

01168 **Allen, Gary Wayne.** A sedimentary analysis of the Sustut and Bowser Formations of north-central British Columbia, Canada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 323-324, 1970.

08457 **Almy, Charles C., Jr.** Sedimentation and tectonism in the Upper Cretaceous Puerto Rican portion of the Caribbean Island Arc, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 269-279, illus., 1969.

Detailed study of the Parguera Limestone in Puerto Rico, combined with regional data, suggests a direct relation between lateral changes in rock type and tectonism. Upper Cretaceous-Eocene deformation in western Puerto Rico consists of NW trending open folds cut by W-trending strike-slip faults; regional overthrusting is not found. Tectonic isolation of the Parguera Limestone is suggested by internal consistency of the unit versus abrupt changes to other rock types on margins and by contemporaneity of volcanic units. Contemporaneous tectonism and sedimentation is shown by included volcanic flows and thinning of the limestone towards structurally high areas. Orientation of major structures in Puerto Rico suggests SW-directed horizontal compressive stresses were resolved along vertical shear fractures rather than on low-angle thrust faults, possibly related to global plate tectonics. — VSN

Alpha, Tau Rho. *See* Marlow, M. S. 01376

08788 **Alsop, L. E.; Oliver, Jack E.** (editors). Premonitory phenomena, associated with several recent earthquakes and related problems (introduction): EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 376-377, 1969.

This report on the third Joint U.S.-Japan Conference on Earthquake Prediction, held in Menlo Park, Calif., on October 28-November 1, 1968, serves as introduction to the summaries of individual papers (cited separately) which follow. — DBV

Alvord, D. C. *See* McKay, E. J. 08789

01193 **Alwin, John A.; Scott, W. Frank.** Clastic dikes of the Touchet Beds, southeastern Washington [abs.]: Northwest Sci., v. 44, no. 1, p. 58, 1970.

01164 **Anderson, David N.; Land, P. E.** Cymric oil field: California Oil Fields — Summ. Operations 1969, v. 55, no. 1, p. 5-21, illus., tables, 1970.

Cymric field, on the west side of the San Joaquin Valley, Kern County, contains more than 1,000 producing wells and ranks 16th in average daily production and 31st in cumulative production in California. The sequence of sedimentary rocks comprises an almost complete stratigraphic column from Holocene to upper Eocene. All structures have resulted from orogenic disturbances occurring from late Eocene to the present and are related to the right lateral movement along the San Andreas rift. The Cymric anticline is a doubly plunging, northwest-trending structure cut along its apex by a network of steeply dipping faults. The principal producing zones are the: Tulare, Etchegoin, Reef Ridge, Carners, Agua, Phacoides, Oceanic, and Point of Rocks. Cumulative production totals more than 111 million bbl. oil and 93 million MCf gas. — MCM

01047 **Anderson, James H.** Holocene environments in the Atlin Valley, northwestern British Columbia, as determined by palynology [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 373, 1970.

01194 **Anderson, T. D.** Seasonal variation in physical and chemical properties of two central Washington soils [abs.]: Northwest Sci., v. 44, no. 1, p. 58, 1970.

08463 **Andress, Noel E.; Cramer, Fritz H.; Goldstein, Robert F.** Ordovician chitinozoans from Florida well samples, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 369-375, illus., 1969.

Ordovician chitinozoans recovered from a grayish black shale are described for the first time for subsurface North-Central Florida. The bottom-most sample of the Sun Oil Company, Earl Odom No. 1 well, Suwannee County, Fla., was bracketed as Late Arenigian to Early Caradocian. The Ordovician is immediately overlain by Silurian sediments. A new chitinozoan species is described. — Authors' abstract

Andress, Noel E. *See* Goldstein, Robert F. 08525

01251 **Andrews, J. T.; Buckley, Jane T.; England, J. H.** Late-glacial chronology and glacio-isostatic recovery, Home Bay, east Baffin Island, Canada: Geol. Soc. America Bull., v. 81, no. 4, p. 1123-1148, illus., tables, 1970.

Retreat of fiord glaciers was rapid (average 27 m yr^{-1}) between 10,000 and about 8,000 B.P. Evidence for a major readvance about 8,000 years ago includes the Ekalugad Moraine, similar in age (C-14) to the Cockburn Moraine of Arctic Canada. Another moraine, dated about 6,000 B.P., is of similar age to the Isortoq Moraine of west Baffin Island. Valley glaciers were still descending to near sea level 4,500 to 4,000 years ago. Disappearance of the interior ice sheet apparently coincided with or preceded growth of local ice caps. Marine limit elevations are a function of distance from the continental shelf and date of deglaciation; elevations incline inland to the Ekalugad Moraine, then decline inland, reflecting slow deglaciation and restrained rebound. Glacio-isostatic recovery has led to warping of marine planes. Maximum tilt on the oldest strandline (8,600 years) is 1.8 m km^{-1}. — *from* Authors' abstract

01138 **Andrews, James E.; Shepard, Francis P.; Hurley, Robert J.** Great Bahama Canyon: Geol. Soc. America Bull., v. 81, no. 4, p. 1061-1078, illus., 1970.

Recent studies of the Great Bahama Canyon give a greatly improved picture of this large valley. The canyon has two major branches, one following Northwest Providence Channel and the other the Tongue of the Ocean. Seaward of the juncture canyon walls are almost 3 miles high, highest of any canyon wall in the world. The total canyon length is at least 150 miles. The canyon system has winding courses, with numerous tributaries descending the walls from the shallow Bahama Banks. Bottom photographs from outer portions of Northwest Branch and Tongue Branch show wall rock, rounded cobbles, and boulders along their axes, as well as ripple-marked

sand to indicate importance of currents moving along the canyon floor. Limestone solution is suggested by numerous isolated depressions along the floor of Northwest Branch, and by caverns along the wall. The modern canyons apparently are due primarily to submarine erosion, partly re-excavating old filled troughs, while the Bahama Banks grew. — ER

01219 **Anstey, Robert L.; Perry, T. G.** Biometric procedures in taxonomic studies of Paleozoic bryozoans: Jour. Paleontology, v. 44, no. 2, p. 383-398, illus., tables, 1970.

Paleozoic bryozoan colonies can be classified into phenetic groupings (phenons) by coding a sufficient number of two-state (qualitative) characters, calculating coefficients of affinity, and clustering specimens on the basis of the coefficients obtained. Such phenons should prove equal to or more useful than presently available artificial taxonomic concepts in most groups of Paleozoic bryozoans. Further refinement in classification can be provided by the incorporation of multistate (quantitative) characters using measures of correlation and taxonomic distance. — *from* Authors' abstract

08449 **Antoine, John W.** Geophysical studies of the northern Florida Platform, Gulf of Mexico [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 263, 1969.

01274 **Applegate, Shelton P.** Digging fossil whales in Mississippi with southern hospitality: Los Angeles County Mus. Nat. History Quart., v. 8, no. 3, p. 26-31, illus., 1969-70.

This is a popular account of a collecting expedition in the Jackson area of Mississippi. — MCM

08734 **Appling, R. N., Jr.** Manganese, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 148-152, illus., 1969.

Small amounts of manganese ore have been shipped from 11 deposits in northeastern Oregon and from at least one deposit in southwestern Oregon. Minor occurrences of manganese have been reported throughout the State. Potential manganese resources are limited, because the deposits are small, irregular, low grade, and, in many places, off-grade because of silica content. — MHM

08839 **Araki, Tadashi; Noguchi, Kimio.** Vanadium and molybdenum contents in hot spring waters in Yellowstone National Park [in Japanese with English abs.]: Balneol. Soc. Japan Jour., v. 20, no. 2, p. 109-117, illus., tables, 1969.

Seventy samples of water from hot springs in Yellowstone National Park, collected in 1962 and 1965, were analyzed for V and Mo by the colorimetric method. The contents of these elements were 0.0005 mg/l to 0.0486 mg/l for V and 0.005 to 0.133 mg/l for Mo. Vanadium was distinctly high in waters of pH-value lower than 2.0 and higher than 10.0. Mo content did not increase with increasing sulfuric acid, but did increase with increasing Cl. It is supposed that vanadium in water was derived from rocks by reaction of strongly acid water containing sulfuric acid or of strongly alkaline thermal water; Mo was derived from the original thermal water of Yellowstone Park. — *from* Authors' English abstract

08459 **Arden, Daniel D., Jr.** Geologic history of the Nicaraguan Rise, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 295-309, illus., 1969.

Refraction seismic velocities beneath the Caribbean Sea and nearby Atlantic Ocean reveal that the thickest crust is in the Antillean island belts and Nicaraguan Rise. Maximum thickness for the Rise is about 22 km to the south of the present topographic crest. Oldest rocks in the Caribbean are Jurassic, in agreement with origin in early Mesozoic as a result of drift between the American and Afro-European continental blocks. Throughout Jurassic-Lower Cretaceous, the Nicaraguan Rise was a mobile belt of submarine lava flows and mafic intrusives. The first phase of the

Laramian orogeny occurred at the end of Cretaceous, and possibly at this time a rift along the southern flank of the Rise separated it from Beata Ridge. In Tertiary, tectonism severely altered topography and deposition pattern of the Rise. The Cayman Trough rift developed and the Rise tilted southward shifting the crest 80 to 150 km north. — *from* Author's abstract

08488 **Arem, Joel E.; Burnham, Charles W.** Structural variations in idocrase: Am. Mineralogist, v. 54, nos. 11-12, p. 1546-1550, illus., tables, 1969.

Idocrase from several localities crystallizes with space groups not previously reported for this mineral. Violations of glide-plane extinction criteria in the commonly-found space group, *P4/nnc*, appear on single-crystal photographs, but are not observable on high-resolution Guinier-type powder photographs. Cell dimensions of the various modifications are all similar. Structural differences indicated by these symmetry variations are not controlled by gross changes in chemical composition. — Authors' abstract

01123 **Aristarain, L. F.** Chemical analyses of caliche profiles from the high plains, New Mexico: Jour. Geology, v. 78, no. 2, p. 201-212, 1970.

Chemical analyses of 11 samples from 3 caliche profiles from the high plains of New Mexico show that, assuming Al_2O_3 immobile, Ca, C, O, and H were added to the upper parts of the profiles; Mg, S, and Fe^{+3} were added in decreasing amounts from top to bottom; Si and Ti increase slightly in the upper part and considerably in the intermediate zone; K and P remain constant throughout the profiles; and Na and Fe^{+2} do not show clear trends. The distribution of elements and structures suggests that they were transported by water and added to the unconsolidated sediments. Movement of water was from top to bottom under a climate deficient in moisture. The caliches were formed by soil processes. — *from* Author's abstract

01048 **Arnold, Chester A.** Eocene age plantbearing chert in the northwestern United States and adjacent Canada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 373-374, 1970.

Ashbee, K. H. G. *See* Baëta, R. D. 08489

Ashbee, K. H. G. *See* Baëta, R. D. 08490

Austin, Ronald L. *See* Rhodes, Frank H. T. 01101

01189 **Austin, Ronald L.** Phylogeny and homeomorphy of conodonts in the Lower Carboniferous [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 374, 1970.

01195 **Aviolo, Gennara; Baggs, Don W.** Paleogeography of the Prune Hill area, Camas, Washington, and its relation to the geologic history of the Portland area [abs.]: Northwest Sci., v. 44, no. 1, p. 58, 1970.

Ayer, Nathan J. *See* Collinson, Charles. 01064

08690 **Badgley, Peter C.; Childs, Leo F.** Earth resources surveys from space, [Chap.] 1 *in* Oceans from space (P. C. Badgley, L. Milroy, and L. Childs, editors) — Symposium, Houston, Tex., Proc.: Houston, Tex., Gulf Publishing Co., p. 1-28, illus., 1969.

NASA's program of combinations of space flight instruments, subsystems, observational techniques for gathering data, and results of tests with manned and unmanned spacecraft is reviewed. Applied to geology, aims are to aid in discovery and exploitation of mineral and petroleum resources, and location and better use of water and of rural and metropolitan land areas. Advantages include relatively vibration-free platforms, detection of broad scale features, fewer problems of assembling airphoto mosaics, more orthographic view, reduced costs and data acquisition time, continental coverage and that of remote areas beyond practical range of aircraft, and global survey assistance without need for on-site basing support. — GDC

08691 **Badgley, Peter C.; Miloy, Leatha; Childs, Leo F.** (editors) Oceans from space — Proceedings of a symposium on the status of knowledge, critical research needs, and potential research facilities relating to the study of the oceans from space, Houston, Texas: Houston, Tex., Gulf Publishing Co., 234 p., illus., tables, 1969.

These proceedings are the result of a joint effort of the American Society for Oceanography, the Gulf Universities Research Corporation, and the National Aeronautics and Space Administration. Exploration of the subject, oceans from space, seemed ideally suited to furthering the objectives of ASO and GURC, and the topic ideal for the Houston area because of the proximity of the Manned Spacecraft Center and Spacecraft Oceanography programs in Texas. Of the 15 chapters by various contributors, three (by Badgley and Childs; Ross; and McLerran) are cited separately. — GDC

01223 **Baer, Norbert Sebastian.** Topochemical studies on calcite [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3581B, 1970.

Baerreis, David A. *See* Bender, Margaret M. 01339

08489 **Baëta, R. D.; Ashbee, K. H. G.** Slip systems in quartz—[Pt.] 1, Experiments: Am. Mineralogist, v. 54, nos. 11-12, p. 1551-1573, illus., tables, 1969.

Single crystals of synthetic quartz were cut into compression test specimens of various orientations and deformed at elevated temperatures and at atmospheric pressure. No macroscopic evidence of plastic flow was detected at an imposed strain rate of 10^{-3} sec.$^{-1}$. At an imposed strain rate of 10^{-4} sec^{-1}, plastic flow was possible only at temperatures above 600°C and, with a strain rate of 10^{-5} sec^{-1}, there was plastic flow at 575°C and above. Below 700°C slip was predominantly basal and in a crystallographic *a* direction. Between 700°C and 850°C, slip occurred with equal facility in the crystallographic *a* and *c* directions, and on many low index planes co-zonal with these directions. At 750°C and above, slip also occurred on pyramidal planes and in the directions <*a*+*c*>. These observations are discussed in terms of the nature of dislocation cores in quartz. — Authors' abstract

08490 **Baëta, R. D.; Ashbee, K. H. G.** Slip systems in quartz—[Pt.] 2, Interpretation: Am. Mineralogist, v. 54, nos. 11-12, p. 1574-1582, tables, 1969.

Estimates have been made using linear anisotropic elasticity theory of both the noncore energy and the "ease of slip" for several basal and prismatic dislocations in high-quartz. The influence of the crystal structure on slip is discussed, and the criterion for basal and (or) prismatic slip is considered in relation to some measurements of the critical resolved shear stress for slip. It is suggested that the slip direction is more important than the slip plane in deciding the choice of glide parameters in quartz. — Authors' abstract

Baggs, Don W. *See* Aviolo, Gennara. 01195

Bailey, E. H. *See* Brooks, H. C. 08735

Bailey, N. G. *See* Dahlem, D. H. 08515

Bailey, Palmer K. *See* Clayton, Lee. 01062

Bailey, R. A. *See* Smith, R. L. 01208

08487 **Bailey, S. W.** Refinement of an intermediate microcline structure: Am. Mineralogist, v. 54, nos. 11-12, p. 1540-1545, tables, 1969.

The structure of Spencer *U* microcline has been refined again by modern computing methods. The *T*-o bond lengths differ only slightly from those of the previous study, but in a consistent direction to indicate a smaller degree of Si, Al order. — Author's abstract

01127 **Baker, Donald R.; Claypool, George E.** Effects of incipient metamorphism on organic matter in mudrock: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 3, p. 456-468, illus., 1970.

Compared with unmetamorphosed carbonaceous mudrock, correlative but incipiently metamorphosed mudrock contains less hydrocarbon, the proportion of saturated vs. aromatic hydrocarbon is higher, the saturated and aromatic hydrocarbon fractions have lower melting points, saturated hydrocarbon fractions have lower average molecular weights, aromatic fractions have less color, and there is progressive enrichment of C-13 in the residual kerogen as the degree of incipient metamorphism increases. These differences should provide a basis for recognizing and classifying incipient metamorphic facies, and the use of hydrocarbons (to indicate degree of metamorphism) may also provide a new basis for assessing and evaluating petroleum potential of unexplored regions. — BHK

01345 **Baldwin, Brewster.** The creative curriculum: Jour. Geol. Education, v. 18, no. 2, p. 91-93, 1970.

For teaching geology on an undergraduate college level, Baldwin recommends emphasis on the creative aspect and independent research. — EH

Baldwin, Ewart M. *See* Lund, Ernest H. 08655

08528 **Ball, M. M.; Harrison, C. G. A.** Origin of the Gulf and Caribbean and implications regarding ocean ridge extension, migration, and shear, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 287-294, illus., 1969.

The Gulf and Caribbean are a zone of N-S extension and left lateral shear opened between the Americas as the continents moved westward from Africa, related to ocean floor spreading away from the Mid-Atlantic Ridge. To accommodate spreading, the ridge migrates westward from Africa, radially outward and resulting in opening triangular sheared grabens and apexes against Africa. A new ridge segment extends across these openings. Spreading rates vary and the migrating ridge is sheared on fracture zones in response to these variations. Current concepts of plate tectonics and transform faults are inconsistent with ridge migration and shear because they deny shear on fracture zones beyond ridge offsets and in the sense indicated by position of ridge segments. T-intersections of ridges are intersections of a spreading, migrating ridge and a shear. Shear is active only on the side toward which migration is taking place; the Mid-Atlantic Ridge-Azores-Gibraltar Ridge is an example. — *from* Authors' abstract

08453 **Ball, Mahlon M.; Oglesby, Woodson R.** A gravity survey of Florida Bay and the lower keys [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 266, 1969.

08647 **Bandy, Orville L.; Vincent, Edith; Wright, Ramil C.** Chronologic relationships of orbulines to the *Globorotalia fohsi* lineage [with Spanish abs.]: Rev. Española Micropaleontología, v. 1, no. 2, p. 131-145, illus., 1969.

In tropical areas four important foraminiferal datum planes, *Globigerinoides trilobus*, *Orbulina*, *Globorotalia menardii*, *Sphaeroidinella dehiscens*, respectively, delimit and subdivide the Miocene; *Praeorbulina* and *Orbulina* species first appear at the base of the four zones of the *Globorotalia fohsi* lineage (middle Miocene), the upper limit of these zones being at or near the *G. menardii* datum. By contrast, in temperate areas of the eastern Pacific, California, and elsewhere, the orbulines first appear in the upper zones of *G. fohsi; O. universa* usually appears with *G. menardii* at base of upper Miocene. Later appearance of orbulines in higher latitudes is attributed to their polyphyletic origin; most tropical orbulines probably arose first at base of middle Miocene from *Globigerinoides* species; most temperate orbulines arose later from *Globigerina* species. — VMJ

01206 **Barghusen, Herbert R.; Hopson, James A.** Dentary-squamosal joint and the origin of mammals: Science, v. 168, no. 3931, p. 573-575, illus., 1970.

The dentary-squamosal jaw joint evolved more than once in advanced cynodont therapsids or their descendants, probably as a buttress against the reaction force created at the articulation by the adductor jaw musculature. The multiple origin of this joint suggests that additional criteria are required to separate early mammals from advanced therapsids. — Authors' abstract

01307 **Barker, Fred.** Ortega Quartzite and the Big Rock and Jawbone Conglomerate Members of the Kiawa Mountain Formation, Tusas Mountains, New Mexico, *in* Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1968: U.S. Geol. Survey Bull. 1294-A, p. A21-A22, 1970.

08658 **Barker, Fred; Peterman, Zell E.; Hildreth, Robert A.** A rubidium-strontium study of the Twilight Gneiss, West Needle Mountains, Colorado: Contr. Mineralogy and Petrology, v. 23, no. 4, p. 271-282, illus., table, 1969.

The Precambrian trondhjemitic Twilight Gneiss of West Needle Mts., southwestern Colorado, and its interlayered amphibolite and metarhyodacite yield a Rb-Sr isochron of 1,805 ± 35 m.y. A low initial Sr-87/Sr-86 ratio of 0.7015 implies that metamorphism of these rocks to amphibolite facies took place soon after emplacement. The mild metamorphism of Uncompahgran age, prior to 1,460 m.y. ago, and Laramide volcanism did not affect the Rb-Sr system in the Twilight. Rb contents of 26.5 to 108 ppm, Sr contents of 114 to 251 ppm, and K_2O percentages of 1.23 to 3.64 in the Twilight Gneiss, in conjunction with high K/Rb ratios and low initial ratio of Sr-87/Sr-86, lend support to geologic data that suggest the Twilight originated as volcanic or hypabyssal igneous rocks in a basaltic volcanic pile. — *from* Authors' abstract

01292 **Barla, G.; Wane, M. T.** Stress-relief method in anisotropic rocks by means of gauges applied to the end of a borehole: Internat. Jour. Rock Mechanics and Mining Sci., v. 7, no. 2, p. 171-182, illus., 1970.

The stress-relief method for the determination of the ground stress tensor is a common procedure in rock mechanics. In particular, the method of applying gauges to the end of a borehole is a well established technique. Investigations, both experimental and theoretical, indicate that large discrepancies can exist in the determination of the ground stress tensor when the rock substance is not the ideal elastically isotropic material assumed for the reduction of data. The purpose of this paper is to extend the analysis of strain gauges applied to the end of a borehole to rock material more closely approximate to an orthotropic substance. — Authors' abstract

01049 **Barnes, Christopher R.; Rexroad, Carl B.; Miller, James F.** Lower Paleozoic conodont provincialism [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 374-375, 1970.

01050 **Barnes, Christopher R.; Sass, Daniel B.; Monroe, Eugene A.** Ultrastructure of some Ordovician conodonts [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 375, 1970.

08567 **Barnes, David F.** (editor). Symposium on gravity surveys in western North America [San Francisco, 1968]: EOS, v. 50, no. 10, p. 524-525, illus., tables, 1969.

The purpose of the symposium held during the American Geophysical Union meetings in San Francisco, 1968 was to provide an up-to-date picture of gravity surveys completed and in progress for all of western North America and the adjacent continental shelf. During the morning session representatives of individual groups of investigators summarized the objectives, progress, coverage, datum control, and calibration standards; in the afternoon, emphasis was placed on special ways to improve standards and to show how gravity data are combined with other types of geophysical data to attain specific objectives. —GV

08570 **Barnes, David F.; Oliver, Howard W.; Robbins, Stephen L.** Standardization of gravimeter calibrations in the Geological Survey, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 526-527, illus., table, 1969.

Fifteen mountain loops have been established by the U.S. Geological Survey for gravimeter calibration. Detailed descriptions of the loops, together with maps, photographs, diagrams and tables of differences are available from the investigators responsible. All the stations are marked; most have been located where accessibility is easy and where vibrations and terrain gradients are small. A table is presented listing the 15 base cities, the mountain or area, base gravity, range in gravity (mgals), number of stations, road length, hours required, responsible investigator and his location, and the year the loop was established. — GV

08579 **Barnes, David F.** Progress on a gravity map of Alaska, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 550-552, illus., 1969.

The methods and problems involved in the acquisition of data for the state gravity map with a 10-mgal contour interval on a scale of 1:2,500,000 are discussed. The Alaska map is expected to reveal: (1) the gravity fields associated with the major topographic and geologic features of the state, (2) an indication of the isostatic adjustment and crustal thickness associated with various topographic features, (3) a basis for estimating regional gradients that influence interpretation of local gravity surveys, (4) suggestions of unexpected thickness and density contrast for some geologic units previously believed to be structurally unimportant, and (5) areas where more detailed surveys are needed. Two figures show the gravity coverage now available in the U.S.G.S.'s files, and the preliminary 20-mgal contour map prepared from these data. — GV

01051 **Barnett, Stockton G.** Biometric analysis of the conodont species *Spathognathodus remscheidensis* in eastern New York and northern New Jersey [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 375-376, 1970.

Bassinger, B. G. *See* Weeks, L. A. 08530

Batchelder, George L. *See* Cole, Gerald A. 08607

Bates, Robert G. *See* Cohee, George V. 01373

01203 **Bauleke, Maynard P.; Hladik, William B.** Expansion characteristics of Calvert volcanic ash (Pliocene) in Kansas, *in* Short papers in research in 1969: Kansas Geol. Survey Bull. 199, pt. 1, p. 9-10, illus., tables, 1970.

Calvert volcanic ash (Pliocene) has been expanded, producing a low-density closed cellular structure similar to that produced in Pearlette volcanic ash (Pleistocene). Expanded bulk density is somewhat higher than that of the Pearlette ash. — Authors' abstract

01374 **Bayley, R. W.** Structure and mineralization of Precambrian rocks in the Galena-Roubaix district, Black Hills, South Dakota: U.S. Geol. Survey Bull. 1312-E, p. E1-E15, illus., table, geol. map, 1970.

The Galena-Roubaix district is underlain by tightly folded and moderately metamorphosed Precambrian sedimentary and volcanic rocks; refolded folds are characteristic. Oldest exposed rocks, previously mapped as amphibolite and Homestake Formation, are believed equivalent to the multi-unit Flag Rock Formation which lies above the Ellison Formation in the Lead district. Sparse gold occurs in ferruginous chert, vein quartz, and quartz-veined graphitic and ferruginous schist, particularly in crests of plunging anticlines. The Homestake, if present, must lie at considerable depth beneath crests of plunging folds. A hole drilled 1,850 feet into one anticline passed through the Flag Rock into banded garnet slate of undetermined correlation. About 250 feet of pyrrhotite are discordant with surface structures and are not understood. — *from* Author's abstract

Beall, A. O. *See* Ewing, M. 08532

08545 **Beall, A. O., Jr.; Fischer, A. G.** Sedimentology, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to

Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 521-593, illus., table [1969,].

Main types of sediment are considered under: organogenic pelagic sediments, turbidites, pebbly muds, paraglacial terrigenous muds, brown and red deep-sea clay, and others, mainly volcanogenic. Radiographs of 20 cores, and 25 smear slides are included. Textural and mineral composition are described and shown in graphs, table, ternary plots, and 36 microphotos. Sedimentary structures discussed include turbidites, pebbly mudstones, pelagic and hemi-pelagic sediments, and laminites, illustrated by core photos. Physical properties selected for discussion are: bulk density and natural gamma-ray emission measurements, results of penetrometer tests on fine-grained portions, and down-hole measurements. Chemical diagenesis of carbonates, chert, and iron minerals are dealt with, and 18 thin sections conclude the paper. — ESL

08552 **Beard, John H.** Pleistocene paleotemperature record based on planktonic foraminifers, Gulf of Mexico, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 535-553, illus., 1969.

Planktonic foraminifers from deep-water sediment cores in northern Gulf of Mexico indicate alternating cold- and warm-water faunas interpreted to represent glacial and interglacial stages of the Pleistocene. *Globorotalia menardii* (warm) and *Globorotalia inflata* (cold) are the most sensitive indicators for delineating severe changes in Pleistocene temperature. The cold-warm cycles are correlated with water-depth changes in the shallower shelf environment. Cold intervals are times of lowered sea level and correlate with glacial stages of North America. Placement of the Plio-Pleistocene boundary at 2.8 m.y. ago allows recognition of five major glacially related events in the marine Pleistocene. Correlation of the marine Calabrian Stage of Italy with the marine Nebraskan Stage, here defined, is suggested. Paleomagnetic stratigraphy facilitates dating and correlating marine stages. *Globorotalia pertenuis*, n. sp., is described. — *from* Authors' abstract

08628 **Becerra Hernández, A.** Estudio bioestratigráfico de la formación Tamabra del Cretácico en el Distrito de Poza Rica [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 84, 1969.

01052 **Becker, Leroy E.; Dawson, T. A.; Patton, John B.** The Precambrian-to-Ordovician transition in Indiana [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 376, 1970.

08699 **Beckman, Michael A.** Middle Archaic complex of northwest Arkansas: Arkansas Acad. Sci. Proc., v. 23, p. 197-208, illus., 1969.

During the long Altithermal period following Wisconsin glaciation, Arkansas developed a typical desert environment, with clumps of bushes that caught windblown dust and sand giving rise to prairie mounds (Quinn, 1961); there was extensive alluviation. The age of the alluvium may be determined by six projectile points from Fayetteville City Park at burial depths of 3 to 6 feet; these represent four styles described herein, most abundant of which are basal-notched. This style was also collected from a Lake Sequoyah site, where associated stones appear to have been brought in for use at Middle Archaic hearths (6,000-3,000 B.C.). The prairie mounds represent a surface formed between 4,000 and 3,000 B.C., preserved by new plant cover that came with increased precipitation as the Altithermal died out. — GDC

01342 **Behre, Charles H., Jr.** Necessary curricula for careers in applied economic geology: Jour. Geol. Education, v. 18, no. 2, p. 77-80, 1970.

Behre suggests that the economic geology curriculum on the university level should include courses on mining engineering and methods, estimation of reserves, mineral production and marketing, metallurgy, mineral law, and professional ethics. In a survey of 160 universities and technical institutes, he found that the majority gave no such courses. Some institutions had mining engineering courses in their engineering school. He concludes that the specialized courses are not necessary for usual un-

dergraduate liberal arts colleges, that they are generally available in technical institutes in the first 4 to 5 years of instruction, and that in smaller universities they could be offered on the graduate level as an introductory course such as "Mining, metallurgy and related practical subjects." — EH

Behrendt, J. C. *See* Popenoe, Peter. 01175

08693 **Bell, Maurice E.; Bodkin, Joseph B.; Inman, Maurice C.; Suhr, Norman H.** A facility for analytical research and service analysis — The Mineral Constitution Laboratories: Earth and Mineral Sci., v. 38, no. 8, p. 61-65, illus., 1969.

The laboratories were first organized in 1952 to make available a wide array of analytical equipment too costly for an individual or department to assemble. In addition to service work for individual research contracts, development of new and improved analytical methods, research on new instrumental techniques and broadening of their application, and support for preparation and presentation of results of research by the staff were essential to attract a qualified staff. The laboratories are organized into sections: analytical, X-ray diffraction and fluorescent spectrometry, optical spectroscopy and infrared ultraviolet absorption spectrometry, electron microscopy and diffraction, electron microprobe analysis, and mass spectrometry. Activities and functions of each are detailed. — ESL

08630 **Bello Orta, G.; Elorduy Téllez, E.; Ramírez, N.M.** Determinación del relieve del basamento en el Distrito de Poza Rica [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 84, 1969.

01339 **Bender, Margaret M.; Bryson, Reid A.; Baerreis, David A.** University of Wisconsin radiocarbon dates VII: Radiocarbon, v. 12, no. 1, p. 335-345, 1970.

Radiocarbon dates obtained since August 1968 are reported on archeologic samples from Iowa, Wisconsin, Nebraska, Kansas, Oklahoma, and Illinois; and on geologic samples from Wisconsin, Louisiana, Iowa, Colorado, Canada, and Peru. — MCM

Benson, A. L. *See* Burgess, R. J. 01288

Berger, G. W. *See* York, D. 01173

01348 **Berger, Wolfgang H.** Planktonic Foraminifera — Selective solution and the lysocline: Marine Geology, v. 8, no. 2, p. 111-138, illus., tables, 1970.

Samples derived from sediment and from plankton were exposed for four months on a taut wire buoy in the central Pacific, in order to assess the effects of solution on foraminiferal death assemblages. The rate of destruction varied for different species and for different variants within species. Sediment assemblages therefore should tend to become enriched with resistant (nonspinose) species and with opaque (usually thick-shelled), zero and negative forms, i.e., specimens with small terminal chambers. Distribution of resistant forms on the East Pacific Rise shows there exists a level of rapid solution increase (the lysocline) at a depth of about 4000 m in the tropics on the western side of the Rise. The lysocline surface slopes upward toward Antarctica and toward South America. An associated oxygen roof is implied. — *from* Author's summary

Berggren, W. A. *See* Ewing, M. 08532

08546 **Berggren, W. A.** Cenozoic foraminiferal faunas, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 594-607, illus. [1969,].

The biostratigraphic results of an examination of the Cenozoic foraminiferal faunas in cores from the seven sites drilled and cored in the Gulf of Mexico and Atlantic Ocean during Leg 1 of the Project are discussed. A summary of the significant foraminiferal elements at each site is followed by a comparison between sites where

pertinent. Separate discussions on average rates of sedimentation are presented, if they have a bearing on estimated positions of geologic boundaries and correlation of biostratigraphic intervals. The scheme proposed by Blow (1969) has been used to assign core intervals to planktonic foraminiferal zones. — ESL

01053 **Bergstrom, Robert E.** Environmental geology — A state of mind [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 376-377, 1970.

01054 **Bergström, Stig M.; Sweet, Walter C.** Evolutionary trends in Ordovician prioniodid conodonts [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 377, 1970.

08703 **Berry, Richard; Jörgensen, Per.** Separation of illite and chlorite in clays by electromagnetic techniques: Clay Minerals, v. 8, no. 2, p. 201-212, illus., table, 1969.

Two types of cells for magnetic separation of clay minerals in aqueous suspension were designed. The cells can be used with a standard Franz Isodynamic Separator. The technique reported is effective in separating chlorite from a natural clay mixture. — Authors' abstract

01213 **Berry, William B. N.** Late Ordovician graptolites from northern Michigan: Jour. Paleontology, v. 44, no. 2, p. 270-275, illus., 1970.

Graptolites from the Haymeadow Creek Member near Rapid City, Mich., suggest a correlation of the shale containing them with the Utica Shale and Lorraine Group in New York and indicate an Eden age (not Trenton, as thought by Hussey, 1952). Three diplograptid species are described, none new. The presence of a correlative of the Eden indicates a more complete Middle and Upper Ordovician sequence in Michigan than previously known. — JWH

01055 **Bickley, William B., Jr.; Cvancara, Alan M.** Paleolimnology and paleoecology of a Pleistocene-Holocene lacustrine deposit, southeastern North Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 377-378, 1970.

01137 **Bird, John M.; Dewey, John F.** Lithosphere plate-continental margin tectonics and evolution of the Appalachian orogen: Geol. Soc. America Bull., v. 81, no. 4, p. 1031-1059, illus., 1970.

Pre-orogenic Appalachian sedimentation patterns are similar to the patterns along modern continental margins, island arcs, and trenches. Development of stratigraphic and tectonic zones and deformation along the eastern margin of North America began with thinning, and then separation of parts of a North American-African continent, which resulted in a widening Proto-Atlantic ocean with a midocean ridge along which plate accretion occurred. Following this, in Ordovician time, the Proto-Atlantic ocean began to close as crust was consumed and deformed along a trench, or complex of trenches marginal to the drifting North American continent. — WHN

08843 **Bird, John M.** Middle Ordovician gravity sliding — Taconic region, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 670-686, illus., 1969.

The Taconic sequence is both autochthonous and allochthonous. The allochthonous rocks constitute the Taconic klippe, extending from southeastern New York to west-central Vermont; they are of Cambrian (?), Cambrian, and Early and Middle Ordovician ages. Surrounding autochthonous carbonates are of like ages. Autochthonous rocks of the sequence are Middle Ordovician shale and graywacke, and extensively overlie the carbonate rocks. Complex relations within the allochthon and between it and the autochthon involve regionally extensive, successive thrust slices, Wildflysch-type conglomerate, and cryptic sedimentary boundaries between the two. Zen proposed that the allochthon was emplaced by westward submarine gravity sliding of Taconic-sequence rocks into mud accumulating in a basin within the region of previous carbonate accumulation. — *from* Author's abstract

01142 **Birman, J. H.** Geothermal exploration for ground water — Reply [to discussion by K. Cartwright of 1969 paper]: Geol. Soc. America Bull., v. 81, no. 4, p. 1283, 1970.

In reply to discussion by Cartwright (ibid., p. 1281-1282), Birman reaffirms broad applicability of his method, clarifies his original statement of purpose, and finds agreement between his data and some of Cartwright's theoretical considerations. — JHF

Bischoff, James. *See* Li, Yuan-Hui. 08850

Blackwelder, Blake W. *See* Pilkey, Orrin H. 08438

Blake, W., Jr. *See* Lowdon, J. A. 01335

01356 **Blow, W. H.** Deep Sea Drilling Project, Leg 2, Foraminifera from selected samples, [Chap.] 14 *in* Initial reports of the Deep Sea Drilling Project — V. 2, Leg 2 of cruises of *Glomar Challenger*, Hoboken, N. J., to Dakar, Senegal, Oct.-Nov. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 357-365, table, 1970.

This summary gives the biostratigraphy as based on the actual samples examined, and does not include data observed by others on a more complete coverage. Age determinations are given for different depths of core for each hole; listing of faunas examined is also given by holes. Ages range from Cretaceous to Pleistocene. — ESL

08539 **Blow, W. H.** Deep Sea Drilling Project, Leg 1 — Foraminifera from selected samples, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D.C., U.S. Govt. Printing Office, p. 392-397, tables[1969?].

A biostratigraphic summary of available samples is presented as a table, followed by a listing of faunas of the 55 samples. — ESL

08461 **Bock, Wayne D.** *Thalassia testudinum*, a habitat and means of dispersal for shallow water benthonic Foraminifera, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 337-340, illus., 1969.

The marine grass, *Thalassia testudinum* König, supplies a substrate for many organisms including benthonic Foraminifera. Sixty-six benthonic forminiferal species were found living on *Thalassia* in a relatively small area of the Florida Keys. Distribution and abundance of these forams are controlled by competition with other organisms in the same environment and by interspecific competition. The grass blades provide a means of dispersal for the benthonic species and when broken by storm waves, they float and can carry organisms to different areas where they can survive and reproduce if conditions are favorable. — *from* Author's abstract

Bodkin, Joseph B. *See* Bell, Maurice E. 08693

08650 **Boggs, Sam, Jr.** Distribution of heavy minerals in the Sixes River, Curry County, Oregon: Ore Bin, v. 31, no. 7, p. 133-150, illus., table, 1969.

The Sixes River is a short, moderately high-gradient stream draining a diverse terrain of igneous, sedimentary, and metamorphic rocks. Size and composition of sand-size heavy minerals contained interstitially in gravels of the river and its tributaries were studied. Samples were collected at 75 localities along the river and beach. Average heavy mineral content ranges from one to six percent. Highest concentrations are generally found upstream. Petrographic analysis shows that a large percentage of the heavy grains are rock fragments. Decrease in heavy grains downstream may be due both to breakdown of heavy rock fragments, and dilution of heavy mineral content by downstream tributaries. There is a fair correlation between magnetite content, one- to seven-tenths percent of sand-size material, and total heavy mineral content. Study of the nonopaque heavy minerals shows clinopyroxene to be most abundant, followed by monoclinic amphiboles. — ESL

08713 **Bogorov, G. V.** Morfometriya severnoy chasti Sredinnogo Atlanticheskogo khrebta [Morphometric features of the northern part of the Mid-Atlantic Ridge (with English abs.)]: Okeanologiya, v. 9, no. 6, p. 1038-1048, illus., 1969.

Based on morphometric analysis of bottom profiles, a quantitative estimate of relief forms within 28 geomorphologic zones of the northern portion of the Mid-Atlantic Ridge is given. The most characteristic quantitative indices are the average horizontal ruggedness of 0.5 to 1 mile (within 19 zones), the average vertical ruggedness of 0 to 100 m (within 21 zones) and the average inclination angles of 2° to 4° (within 11 zones). — Author's abstract

01303 **Bold, W. A. van den.** The genus *Costa* (Ostracoda) in the upper Cenozoic of the Caribbean region: Micropaleontology, v. 16, no. 1, p. 61-75, illus., table, 1970.

Eighteen species and subspecies of genus *Costa* are recorded from the Oligocene-Recent of the Caribbean region; five are new. Five morphological groups are recognized, each occupying its own faunal subprovince and only rarely occurring outside of it: (1) the *Costa variabilocostata* group of northern South America; (2) the *Costa? santacrucensis* group in northern South America until the Pliocene, then shifting to the Antilles; (3) the *Costa barrocoloradensis* group of Central America; (4) the *Costa maquayensis* group of the Antilles; and (5) the *Costa? kugleri* group of northern South America and Central America. No species of *Costa* are known at present from the Neocene of the Gulf Coast, while in Cuba no species have been found in deposits younger than Middle Miocene. — *from* Author's abstract

08820 **Bold, W. A. van den.** Neogene Ostracoda from southern Puerto Rico: Caribbean Jour. Sci., v. 9, nos. 3-4, p. 117-133, illus., table, 1969.

Thirty-two species of ostracodes are reported from the Ponce Formation and from a limestone in the Lajas Valley. The distribution of the ostracodes suggests correlation of these units with the middle part of the Gurabo Formation in the Dominican Republic, late Miocene. One new species, *Cytheretta ponceana*, is described. — Author's abstract

08774 **Bolt, Bruce A.; Eisenberg, A.** Rupture mechanics on the Hayward fault [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 382, 1969.

08475 **Bonatti, E.; Bostrom, K.; Eyl, B.; Rona, E.** Geochemistry, mineralogy and absolute ages of a Caribbean sediment core [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 506, 1969.

01380 **Bond, T. A.** Preliminary pollen analysis and radiocarbon dates from Okefenokee Swamp, Charlton County, Georgia [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s18, 1970.

08682 **Bonet Marco, F.** Microfacies cretácicas de la región de Córdoba-Orizaba [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 85, 1969.

08600 **Bonini, William E.** Gravity studies on Montana, Wyoming, and Washington, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 531-532, illus., 1969.

Since 1965, the Princeton gravity program has been directed mostly toward detailed studies to aid in the solution of specific geologic problems. Some stations have been observed, however, purely to fill in blank areas as a contribution to the preparation of state maps. Worden meter W-57 was used before 1966 and LaCoste-Romberg instruments were used in 1966 and later. A figure identifies areas covered by specific projects for which some preliminary unpublished interpretations are presented: Teton Range and Jackson Hole, Wyoming; Boulder batholith of Montana; Little Rocky Mountains, Montana; Crazy Mountains, Montana; Rocky Mountain trench, Montana; southern Montana and northern Wyoming; and Sunlight Basin, Wyoming. — GV

Bonneville Power Administration. *See* U.S. Geological Survey. 08715

08662 **Boon, John D., 3d.** Quantitative analysis of beach sand movement, Virginia Beach, Virginia: Sedimentology, v. 13, nos. 1-2, p. 85-103, illus., table, 1969.

A simplified stochastic-process model involving statistical procedures is used to analyze sand tracer displacement data on an ocean beach. Using a rectangular sampling grid, tracers were recovered at fixed times, then considered as items in a sample of X and Y displacements from the point of release. Comparison of the adjusted means of these samples on a time-stratified basis gave estimates of average particle velocity in two dynamic zones: (1) swash zone: $v(X) = 0.44$ ft/min (0.22cm/sec) longshore, (2) surf zone: $v(Y) = 0.37$ ft/min (0.19 cm/sec) offshore. Using an estimate of the thickness of the mobile layer (the depth interval in which semi-continuous motion of beach sand occurs), a further estimate of the rate of longshore sand transport was computed at 440 yards^3/day (336 m^3/day). — *from* Author's abstract

Borchardt, G. A. *See* Norgren, J. A. 01200

01252 **Born, Stephen M.; Ritter, Dale F.** Modern terrace development near Pyramid Lake, Nevada and its geologic implications: Geol. Soc. America Bull., v. 81, no. 4, p. 1233-1241, illus., 1970.

The Truckee River rises high in the Sierra Mountains and ends 30 mi northeast of Reno, Nevada, where it empties into Pyramid Lake, the largest remnant of Pleistocene Lake Lahontan. Since 1910, the level of Pyramid Lake has declined 80 feet due to diversion of water from the Truckee River basin. During this period, the river has formed at least six well-developed, erosional terraces located 1 to 6 mi from the present lake and standing between 10 feet and 35 feet above the present stream. Continuous lake-level measurements and periodic aerial photographs establish that the entire terrace sequence formed within a period of 44 years. The Truckee River terrace sequence formed during a rapidly, although intermittently, declining base level, extreme downcutting, and unstable hydrologic regimes. — *from* Authors' abstract

01316 **Bostick, Nell H.** Electronic data processing applied to uranium resource prediction and exploration: Soc. Mining Engineers AIME Trans., v. 247, no. 1, p. 4-10, illus., 1970.

A special electronic system processes data from normal geologic maps and stratigraphic tables to yield predictions of uranium resource location for specific areas. Rock-formation extent, thickness and depth are recorded, as well as geologic parameters such as grain size, color, dip and depositional environment. This information is stored in a computer and when processed yields an output for an area, giving volume of host rock favorable for uranium occurrence to a given depth and at a given favorability level. The system was tested in the Shiprock area of Arizona and New Mexico. Results were plotted by machine in the form of maps, examples of which are given. — EH

Bostrom, K. *See* Bonatti, E. 08475

Bostrom, Robert C. *See* Christensen, Nikolas I. 08580

Boucot, A. J. *See* Johnson, J. G. 01212

Bouma, Arnold H. *See* Chmelik, Frank B. 08435

Bouma, Arnold H. *See* Rezak, Richard. 08439

08444 **Bouma, Arnold H.; Sweet, William E., Jr.** The upper sediment column of the Gulf of Mexico presented in a new type of map, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 171-174, illus., 1969.

Selected cores from the Gulf of Mexico are each presented as a lithological model. A chart symbol is used to indicate gross lithology. A numerical code has been developed which expresses lithologic percentages and indicates by positional notation vertical succession or intercalation of facies. For one area a number of cores are

compared to demonstrate the validity of the technique and to show ratio changes. All results are shown in black and white shadings, symbols and numbers. This new type of sediment distribution map is of value in studies of sediment transport and deposition, basin filling, geotechnical properties, sea lab preparation, salvaging of sunken objects, acoustical measurements, interpretation of shallow continuous reflection seismic profiling, etc. — *from* Authors' abstract

08731 **Bowen, R. G.** Copper, lead, and zinc, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 120-125, illus., tables, 1969.

Complex sulfide ores containing significant percentages of lead, zinc, and smaller amounts of copper occur in the Cascade Mountains as well as in northeastern and southwestern Oregon. Base metal mining in Oregon has been dormant for several years, and total production has been small. Application of modern methods of prospecting and exploration could result in discovery of base metal deposits, especially copper, that could be mined profitably. — MHM

Boyce, R. E. *See* Marlow, M. S. 01376

08561 **Brabb, Earl E.; Churkin, Michael, Jr.** Geologic map of the Charley River quadrangle, east-central Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-573, scale 1:250,000, sections, 1969.

08830 **Brace, W. F.; Byerlee, J. D.** Mechanical instabilities observed in laboratory experiments on rocks [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 400-401, 1969.

08583 **Bradbury, David.** Plants as indicators of rock type [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 26-27, 1969.

01250 **Bradley, W. H.** Green River oil shale — Concept of origin extended, an interdisciplinary problem being attacked from both ends: Geol. Soc. America Bull., v. 81, no. 4, p. 985-1000, illus., tables, 1970.

A much fuller understanding of the Green River oil shale and its organic chemistry will emerge when the geologists, paleontologists, organic chemists, paleolimnologists, and biogeochemists who are now working on it integrate their findings. We know that the biologic progenitors of the organic substance in the shale could only have been microscopic algae and other microorganisms that grew and accumulated in shallow lakes in a subtropical climate. The only nonlacustrine organic components were wind-blown or water-borne pollens and waxy spores. The organic material of the oil shale can be divided into three fractions — a small bitumen fraction, a major fraction called kerogen, and a somewhat smaller inert fraction. The blue green algal ooze now forming in Mud Lake, Florida, has been studied as a possible present day analog of the Green River oil shale precursor. — *from* Author's abstract

01056 **Bradshaw, L. E.; Noel, J. A.; Larson, R. J.** Trace-element composition of bone material in conodonts [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 378, 1970.

Bramlette, M. N. *See* Bukry, David. 08548

08605 **Breed, William J.** A Pliocene river channel in Wupatki National Monument, Arizona: Arizona Acad. Sci. Jour., v. 5, no. 3, p. 177-181, illus., 1969.

This volcanic area near Flagstaff is divided by a vertical fault which dropped the south side 300 feet. On the upside near Doney Crater, a north-flowing stream cut through Moenkopi rocks, 50 feet into Kaibab limestone. A hanging meander at the north end and portions of the main channel contain quartzitic gravels of Shinarump Conglomerate types, but older than more abundant surface gravels; lack of basalt pebbles suggests a nonvolcanic surface drainage, later diverted from its course by lava flows. At Doney Crater the fault scissors into two sections, each downdropped to

the west less than 50 feet. The upper stream channel zigzags, its segments related to jointed structure. Postulated in sequence for the Doney Crater area are: the Black Point monoclinal segment; faulting, possible eruption of oldest basalts; development of surfaces, drainage that formed Doney Channel, and its superposition; younger lava flows and development of modern drainage. — GDC

Breiner, Sheldon. *See* Kovach, Robert L. 08783

Brereton, R. G. *See* Burke, J. D. 01296

01248 **Bretsky, Sara Stewart.** Phenetic and phylogenetic classifications of the Lucinidae (Mollusca, Bivalvia) [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3789B-3790B, 1970.

08491 **Brindley, G. W.** Unit cell of magadiite in air, in vacuo, and under other conditions: Am. Mineralogist, v. 54, nos. 11-12, p. 1583-1591, illus., tables, 1969.

Electron diffraction single-crystal patterns and X-ray powder data are used to evaluate unit cell parameters of magadiite. Under normal air conditions, the unit cell is monoclinic with $a=b=7.25$, $c=15.69$ A, $\beta=96.8°$. *In vacuo*, the structure collapses and the unit cell is monoclinic with $a=b=7.30$, $c=13.73$ A, $\beta=100.5°$. H-magadiite, in dry air and in vacuo, gives a basal spacing of 11.20 A. Basal spacings of H-, Na-, and Ca- magadiite are given for various physical conditions and after saturation with liquid ethylene glycol. — *from* Author's abstract

08495 **Brindley, G. W.; Wiewiora, Krystyna; Wiewiora, Andrzej.** Intracrystalline swelling of montmorillonite in some water-organic mixtures (Clay-organic studies, XVII): Am. Mineralogist, v. 54, nos. 11-12, p. 1635-1644, illus., 1969.

Basal spacings of a Ca-montmorillonite equilibrated in aqueous solutions of methanol, ethanol, *n*-propanol, 1,2-ethanediol, 1,5-pentanediol, acetone, dioxane and morpholine, are measured at concentrations ranging from 0-100 mole percent organic component. With solutions of the monohydric and dihydric alcohols, the basal spacings increase with increasing mole fraction of the organic component up to a limit beyond which the spacing diminishes rapidly almost to that given by the pure organic material. — *from* Authors' abstract

01119 **Brinkmann, Roland.** Memorial to Hans Stille (1876-1966): Geol. Soc. America Proc. 1967, p. 263-267, portrait, 1970.

Brinkworth, G. L. *See* Popenoe, Peter. 01175

08722 **Brooks, H. C.** Geology of the Snake River Canyon, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 74-76, illus., 1969.

Where it marks the Oregon-Washington and Idaho border, the Snake River flows in a steep, narrow V-shaped canyon 2000 to more than 5000 feet deep. Paleozoic and Mesozoic rocks comprise a heterogeneous assemblage of volcanics, sediments, and intrusives. Tertiary rocks are mainly basaltic lavas. — MHM

08732 **Brooks, H. C.; Ramp, Len.** Gold and silver, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 125-143, illus., tables, 1969.

Oregon's gold and silver deposits are concentrated in the eastern Blue Mountains in northeastern Oregon and in the Klamath Mountains in the southwestern part of the State. Principal primary deposits occur in veins near felsic to intermediate intrusive bodies. Oregon is a potentially important source of gold; there is evidence that many known lode deposits have not been exhausted. Beach and marine black sands are currently being investigated; large-scale mining of these deposits could result in considerable gold production. — MHM

08735 **Brooks, H. C.; Bailey, E. H.** Mercury, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 152-158, illus., 1969.

Oregon mines produced about 105,700 flasks of quicksilver through 1966. Mercury occurrences are widespread; there are more than 225 deposits in 17 counties. The most productive deposits are in the southwestern, central, and southeastern parts of the State. More than 99 percent of the mercury produced in Oregon has come from deposits in Tertiary volcanic rocks, tuffaceous lake beds, and marine and nonmarine sandstones. Recently developed mercury detectors and sampling techniques should help in the search for new deposits, especially in areas where soil cover is heavy. — MHM

Brooks, H. C. *See* Ramp, Len. 08738

01201 **Brooks, William H.** Quantitative vegetational differences along the Sevier fault in the Red Canyon area of southern Utah [abs.]: Northwest Sci., v. 44, no. 1, p. 59-60, 1970.

08556 **Brown, Donald L.** Geologic map of the Yuma quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 10-SE, scale 1:24,000, separate text, 1969.

The accompanying text, "Mineral resources summary of the Yuma quadrangle, Tennessee," by C. R. Sykes is cited separately.

08498 **Brown, Edwin H.** Some zoned garnets from the greenschist facies: Am. Mineralogist, v. 54, nos. 11-12, p. 1662-1677, illus., tables, 1969.

Microprobe data and phase relationships of zoned garnets from quartz-feldspar schists of greenschist facies of New Zealand, Scotland, and Vermont suggest that one likely source of garnet is from the reaction of chlorite, epidote, and quartz. Although for most garnets the major portion of the zoning is caused by Mn-depletion, in a few samples the garnet is associated with enough phases that it should be compositionally invariant at constant grade. Zoning in such garnets should be caused by increase in grade. Many garnets are zoned strongly in Fe and Mn but not in Ca. — JWC

08486 **Brown, G. E.; Gibbs, G. V.** Oxygen coordination and the Si-O bond: Am. Mineralogist, v. 54, nos. 11-12, p. 1528-1539, illus., table, 1969.

The mean Si-O bond length in silicate has been found to depend, in part, on the average cation coordination of oxygen and the predicted *s*-character of the metal-oxygen bonds. Individual SiO(nbr) bond lengths in four C2/*m* amphiboles, which apparently deviate from this correlation, are discussed in terms of *d-p* π bonding and the average electronegativity of the other cations bonded to O(nbr). A correlation exists between the Si-O(nbr) bond length in these amphiboles and the average electronegativity of the nontetrahedral cations bonded to O(nbr); longer Si-O(nbr) bonds are associated with the more electronegative cations. — Authors' abstract

08823 **Brown, Jerry.** Ionic concentration gradients in permafrost, Barrow, Alaska: U.S. Army Corps Engineers Cold Regions Research and Eng. Lab. Research Rept. 272, 25 p., illus., tables, 1969.

Distribution of ionic concentration gradients in perennially frozen Coastal Plain sediment can be used to interpret environmental and geomorphic changes. Within short distances, at comparably shallow depths and in sediments of similar texture, concentrations vary between less than 1 meq/100 g and 10 meq/100 g oven-dried soil, representing modification of marine sediment by lake migration and freshening, local and regional thawing, and leaching followed by refreezing. Higher concentrations are found close to the surface in areas unaffected by such processes; lower values are encountered in lake basins and under primary land surfaces. A drained lake basin and a well developed polygon field show depression of ionic concentrations vertically and laterally. A large, drained basin close to sea level contains frozen sediments having very low ionic concentrations, suggesting a prior fresh-water lake. Seasonally thawed soil averages 24 times fewer extractable ions than underlying permafrost. — ESL

01057 **Brown, Jim McCaslin.** Deformation and movement within mylonitic rocks of the Grenville front, southeast of Sudbury, Ontario [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 378-379, 1970.

08434 **Brown, L. F., Jr.** Geometry and distribution of fluvial and deltaic sandstones (Pennsylvanian and Permian), north-central Texas, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 23-47, illus., 1969; *reprinted as* Texas Univ. Bur. Econ. Geology Geol. Circ. 69-4, 1969.

The Late Pennsylvanian-Early Permian Cisco Group, north-central Texas, has 10 to 15 repetitive sequences of open shelf, deltaic, fluvial, and interdeltaic systems. Sediments were transported westward from the Ouachita Mts. across a narrow coastal plain; sandstone facies (delta front sheets, distributary mouth bars, channels, destructional bars) define a southwest paleoslope of 5 feet/mi. Positions of distributary, belt, and composite sandstone patterns and of elongate and multistory sandstone bodies are defined in relation to the paleoslope. Initial Cisco deltas followed a paleosurface grain controlled by underlying bank limestones and maintained the grain for 1200 feet of sedimentation. Each fluvial-deltaic system inherited its geometry from previous systems and provided control for the next. Mapping by the mud decompaction technique confirms the roles of compaction and structure in controlling geometry of sandstone bodies. — VSN

Brown, L. Frank, Jr. *See* Flawn, Peter T. 01383

08847 **Brown, Philip R.** Compaction of fine-grained terrigenous and carbonate sediments — A review, *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 486-495, illus., 1969.

Early compaction of terrigenous mud is controlled primarily by particle size, initially in reverse relation to porosity but changing to direct below a depth of 3,000 feet. This relation should be more meaningful if density and porosity of shales can be determined at their natural depth by use of formation density and sonic logs. Fluids expelled during compaction are important as agents of diagenesis, and possibly carry hydrocarbons; however, such migration was recently considered temperature controlled, rather than of compaction origin. Supratenuous folding, draping over reefs, and contemporaneous faulting are major compaction structures; minor are compacted laminae around nodules and distorted shells within compacted shale. Laboratory experiments show that carbonate muds also compact readily; field observations indicate little or no compaction in carbonate rocks, probably due to early cementation. — GDC

Brown, T. J. *See* Calvert, Paul. 08502

08776 **Brune, James N.** Seismicity, rate of slip, stress and heat flow along the San Andreas fault in California [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 384, 1969.

08456 **Bryant, William; Richards, Adrian F.; Keller, George H.** Shear strength of sediments measured in place near the Mississippi delta compared to measurements obtained from cored material [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 267, 1969.

Bryson, Reid A. *See* Bender, Margaret M. 01339

01228 **Bucke, David Perry, Jr.** Effect of diagenesis upon clay mineral content of interlaminated Desmoinesian sandstones and shales in Oklahoma [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3704B-3705B, 1970.

01336 **Buckley, James D.; Willis, Eric H.** ISOTOPES' radiocarbon measurements VIII: Radiocarbon, v. 12, no. 1, p. 87-129, 1970.

This date list presents results of samples measured during 1968 and 1969 and several made previously for which complete sample data have recently been received. Geologic samples are from the United States, Canada, Europe, Near East, Asia, the

Bahamas, and South America; archeologic samples are from the United States, Mexico, Canada, Europe, Africa, and South America. — MCM

Buckley, Jane T. *See* Andrews, J. T. 01251

Buffington, E. C. *See* Marlow, M. S. 01376

Bukry, D. *See* Ewing, M. 08532

01355 **Bukry, David.** Coccolith age determinations, Leg 2, Deep Sea Drilling Project, [Chap.] 13 *in* Initial reports of the Deep Sea Drilling Project — V. 2, Leg 2 of cruises of *Glomar Challenger*, Hoboken, N. J., to Dakar, Senegal, Oct.-Nov. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 349-355, illus., 1970.

This report combines results of study of 115 coccolith samples from the 78 cores recovered during Leg 2. Light-microscope techniques were used to identify assemblages. For each drilling site, age-diagnostic species in selected samples follow a brief summary of the coccolith stratigraphy. A chart of lower Oligocene assemblages shows the influence of factors of ecology and preservation in progressively more offshore areas. — ESL

08548 **Bukry, David; Bramlette, M. N.** Summary of coccolith biostratigraphy, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 621-623 [1969?].

Holes drilled at seven sites investigated geology of the ocean floor in three major areas. Miocene-Pleistocene sections in the Gulf of Mexico varied widely in thickness, but were related by lithologic and paleontologic stratigraphy; coccoliths present were reworked Cretaceous species. Cores from the Blake-Bahama basin show very thin Tertiary deposits; 15 contain Cretaceous sediments, and one Late Jurassic. There are about 400 m of older sediment not yet sampled. On the Bermuda Rise, a sequence of coccoliths in red clay bridges the Pliocene-Pleistocene boundary. Below this is a sequence of green turbidite and chert containing middle Eocene microfossils. Two cores from below the chert were of nonfossiliferous clay, indicating the ocean floor has been very deep here for at least 50 m.y. One value of coccoliths to deep-sea research is the speed with which they can be used to date a sample. — ESL

08485 **Bunch, T. E.; Fuchs, Louis H.** A new mineral — Brezinaite, Cr_3S_4, and the Tucson meteorite: Am. Mineralogist, v. 54, nos. 11-12, p. 1509-1518, illus., tables, 1969.

Brezinaite, a new chromium sulfide, occurs in the metal matrix and contiguous to silicate inclusions in the *Tucson* iron meteorite. The following average composition of brezinaite was determined by the electron microprobe: Cr 48.3; Fe 3.9; V 1.61; Ti 0.96; Mn 0.86; Ni 0.08; S 45.0, sum 100.71 wt percent. The unit cell is monoclinic with $a = 5.96 \pm 0.01$, $b = 3.425 \pm 0.005$, and $c = 11.27 \pm 0.015$ A; $\beta = 91°32'$, $V = 229.97$ A^3. Calculated X-ray density is 4.12 g per cm^3 ($Z=2$). Very low iron content of the silicates, presence of chromium sulfide, significant amounts of silicon in the nickel-iron, and the chalcophile behavior of vanadium indicate a very high degree of reduction in *Tucson* similar to enstatite chondrites and enstatite achondrites. — Authors' abstract

08572 **Burfeind, Walter J.** Gravity investigations of selected batholiths and basins of southwestern Montana, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 535-537, illus., 1969.

Approximately 6,250 gravity stations were occupied during the period 1960-64 covering 25,000 sq km in southwestern Montana in an effort to determine the source, subsurface shape, and extent of the Boulder and Tobacco Root batholiths, and the prefill configurations and possible origin of several Cenozoic basins. Data collection, reduction, and interpretation are discussed and a Bouguer anomaly map of the area is given. Data suggest that the Boulder batholith is a tabular body with SE and NW contacts that dip NW at a low angle to about -10 km, the NE contact dipping at a steeper

angle SW to about -10 km. Between the Boulder and Tobacco Root batholiths, intrusive rocks underlie the Jefferson basin at about -4 km. East of this basin and adjacent mountains, intrusive rocks crop out as the Tobacco Root batholith, which was apparently emplaced upward from the NW. Surrounding mountain ranges and intermontane basins are discussed. — GV

Burford, R. O. *See* Raleigh, C. B. 08772

01288 **Burgess, R. J.; Benson, A. L.** Exploration for Niagaran reefs in Michigan, Pts. 1-2: Oil and Gas Jour., v. 67, no. 51, p. 80-82, illus., 1969; ibid., no. 52, p. 180, 183-184, 187-188, illus., 1969; ibid., v. 68, no. 1, p. 122-127, illus., 1970.

The regional geology, interpretation of the carbonate bank environment, gravity evaluation, Niagaran geology, drilling practices, and economic analysis are summarized for the northern part of the Lower Peninsula of Michigan where tests are being conducted in exploring for commercial quantities of oil and gas in Silurian reefs. The areal extent of newly discovered reefs is not yet known. The foremost problem is the presence of hydrocarbons in commercial quantities. Nearly all Niagaran tests have some shows of oil and gas, but for the most part are associated with low porosity and permeability. — MCM

Burk, C. A. *See* Ewing, M. 08532

08514 **Burk, C. F., Jr.** The network concept for geoscience data files in Canada [abs.], *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 949, 1969.

01296 **Burke, J. D.; Brereton, R. G.; Muller, P. M.** Desert stream channels resembling lunar sinuous rilles: Nature, v. 225, no. 5239, p. 1234-1236, illus., 1970.

Air photographs of the Mojave Desert show several stream channels that resemble certain lunar sinuous rilles. Examination shows that the difference between rilles and these "normal" stream beds on the alluvial slopes has to do with the presence or absence of a blanket of windblown sand. The primary effect of the windblown sand was to change the balance between erosion and transport for the stream relative to what it would normally be at the point of emergence onto the alluvial pediment. The secondary effect was the softening of most channel topography. The volume of the desert rilles must be distributed at their downstream ends by combined action of water with winds that all channels except the most recent are hidden. On the Moon either the volume evaporated or was smoothed out by some distribution mechanism as it was deposited at the downstream end. — DBV

Burnham, Charles W. *See* Arem, Joel E. 08488

01058 **Buschbach, Thomas C.** Cambrian strata of Illinois [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 379, 1970.

Buseck, Peter R. *See* Lewis, Charles F. 08588

Bush, Patricia A. *See* Bush, Sam A. 08458

08458 **Bush, Sam A.; Bush, Patricia A.** Isostatic gravity map of the eastern Caribbean region, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 281-285, illus., table, 1969.

Thirty-nine newly reduced gravity stations are incorporated with other published and unpublished data to produce a Pratt-Hayford isostatic gravity map of the Antilles Islands and Venezuelan Basin. Negative and positive isostatic anomaly belts of the West Indies island arc are delineated. — Authors' abstract

Byerlee, J. D. *See* Brace, W. F. 08830

08558 **Byerly, Don W.** Geologic map of the Baileyton quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 180-SE, scale 1:24,000, sections, separate text, 1969.

The accompanying text, "Mineral resources summary of the Baileyton quadrangle, Tennessee," by C. P. Finlayson and S. W. Maher is cited separately. — MCM

Caldwell, R. L. *See* Zemanek, Joe. 01257

01384 **Calkin, Parker E.** Strand lines and chronology of the Glacial Great Lakes in northwestern New York: Ohio Jour. Sci., v. 70, no. 2, p. 78-96, illus., tables, 1970.

Restudy of Glacial Great Lake history confirms a sequence of 9 to 10 major lake stands Lake Whittlesey was present between 12,700 and 13,800 yr B.P., with water advance to either Lake Escarpment, Gowanda, or Hamburg End Moraines. Whittlesey lowered to Warren I level about 12,700 B.P. Warren II was briefly formed by a short stand, after which the much lower Lake Wayne was formed and the ice stood at Buffalo Moraine. Warren III followed and receded when the ice retreated from the Batavia Moraine and the lake level dropped to the Lake Grassmere level. Evidence for the lower and later lake stands is sparse. Lake Dana, the last, drained when the ice retreated north of the Niagara escarpment; C-14 dates suggest this was prior to 12,100 yr B.P. At least 170 feet of isostatic uplift has taken place on the Buffalo isobase since Lake Whittlesey time. — HRC

08502 **Calvert, Paul; Brown, T. J.; Uhlmann, D. R.** Thermal effects of shear in opposed-anvil high-pressure devices: Am. Mineralogist, v. 54, nos. 11-12, p. 1732-1736, illus., 1969.

The effect of shearing on the average sample temperature in opposed-anvil high pressure devices is measured as a function of time, shear rate, pressure, temperature, and sample material. While temperature rises as large as 50°C have been observed, for shearing conditions frequently employed, the average temperature rise should be insignificant. — Authors' abstract

01229 **Calvert, Ronald Harold.** Stratigraphy of a Chester cycle in the Kentucky part of the Eastern Interior Basin [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3705B, 1970.

08746 **Cameron, C. C.** Peat, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 218-222, illus., 1969.

Peat production in Oregon began in 1966 with 900 short tons of air-dried peat produced by Jewell's Mother Earth Company at Enterprise in Wallowa County. Deposits such as those in eastern Blue Mountains and the Coast and Cascade Ranges offer the best potential for resources for the expanding peat industry. Many peat deposits in the Basin and Range province have been exploited for farming and are unavailable to industry. — MHM

08807 **Cameron, Francis.** The function of geology in mineral industry decisions: Mining Cong. Jour., v. 55, no. 2, p. 38-44, illus., 1969.

Types of geologic knowledge available to the exploration geologist today include: geologic mapping, regional syntheses, geophysical surveys, field geochemical studies, research to improve ore-finding techniques, ore-forming processes, and supporting research activities. The role of geology in making decisions, changes in knowledge of resource potential, technological developments, and government policy, as well as sources of geologic information and the status of geologic work are discussed. The author is concerned over the decline in amount of geologic mapping being done. — ESL

01190 **Campbell, K. Vincent; Miers, John H.; Nichols, Bruce M.; Oliphant, Jerrelyn; Pytlak, Shirley; Race, Ronald W.; Shaw, George H.; Gresens, Randall L.** A survey of thermal springs in Washington State: Northwest Sci., v. 44, no. 1, p. 1-11, illus., tables, 1970.

The thermal springs of Washington studied in this paper were classified into three groups on the basis of chemical characteristics. The thermal meteoric, volcanic, and

connate waters come from different geologic environments. The compositions of each of these types and the temperatures of the waters reflect the underlying geologic associations. In the case of thermal meteoric and volcanic waters, addition of different amounts of cold ground water containing dissolved CO_2 and calcium explains the variation imprinted on the basic nature of the water. In the case of the connate waters the initial compositions were probably greatly different due to their different origins, and consequently, addition of ground water did not result in a detectable systematic variation. — *from* Authors' conclusions

00982 **Canada Geological Survey.** Aeromagnetic series, Codroy, Newfoundland: Canada Geol. Survey Geophysics Paper 4489, scale 1:63,360, 1970.

00983 **Canada Geological Survey.** Aeromagnetic series, Grandys Lake, Newfoundland: Canada Geol. Survey Geophysics Paper 4490, scale 1:63,360, 1970.

00984 **Canada Geological Survey.** Aeromagnetic series, Sound Island, Newfoundland: Canada Geol. Survey Geophysics Paper 4499, scale 1:63,360, 1970.

00985 **Canada Geological Survey.** Aeromagnetic series, Sunnyside, Newfoundland: Canada Geol. Survey Geophysics Paper 4500, scale 1:63,360, 1970.

00986 **Canada Geological Survey.** Aeromagnetic series, Heart's Content, Newfoundland: Canada Geol. Survey Geophysics Paper 4501, scale 1:63,360, 1970.

00987 **Canada Geological Survey.** Aeromagnetic series, Pouch Cove, Newfoundland: Canada Geol. Survey Geophysics Paper 4502, scale 1:63,360, 1970.

00988 **Canada Geological Survey.** Aeromagnetic series, Port aux Basques, Newfoundland: Canada Geol. Survey Geophysics Paper 4503, scale 1:63,360, 1970.

00989 **Canada Geological Survey.** Aeromagnetic series, Rose Blanche, Newfoundland: Canada Geol. Survey Geophysics Paper 4504, scale 1:63,360, 1970.

00990 **Canada Geological Survey.** Aeromagnetic series, La Poile, Newfoundland: Canada Geol. Survey Geophysics Paper 4505, scale 1:63,360, 1970.

00991 **Canada Geological Survey.** Aeromagnetic series, Burgeo, Newfoundland: Canada Geol. Survey Geophysics Paper 4506, scale 1:63,360, 1970.

00992 **Canada Geological Survey.** Aeromagnetic series, Ramea, Newfoundland: Canada Geol. Survey Geophysics Paper 4507, scale 1:63,360, 1970.

00993 **Canada Geological Survey.** Aeromagnetic series, La Hune, Newfoundland: Canada Geol. Survey Geophysics Paper 4508, scale 1:63,360, 1970.

00994 **Canada Geological Survey.** Aeromagnetic series, Facheux Bay, Newfoundland: Canada Geol. Survey Geophysics Paper 4509, scale 1:63,360, 1970.

00995 **Canada Geological Survey.** Aeromagnetic series, Gaultois, Newfoundland: Canada Geol. Survey Geophysics Paper 4510, scale 1:63,360, 1970.

00996 **Canada Geological Survey.** Aeromagnetic series, Belleoram, Newfoundland: Canada Geol. Survey Geophysics Paper 4511, scale 1:63,360, 1970.

00997 **Canada Geological Survey.** Aeromagnetic series, Terrenceville, Newfoundland: Canada Geol. Survey Geophysics Paper 4512, scale 1:63,360, 1970.

00998 **Canada Geological Survey.** Aeromagnetic series, Harbour Buffet, Newfoundland: Canada Geol. Survey Geophysics Paper 4513, scale 1:63,360, 1970.

00999 **Canada Geological Survey.** Aeromagnetic series, Dildo, Newfoundland: Canada Geol. Survey Geophysics Paper 4514, scale 1:63,360, 1970.

01000 **Canada Geological Survey.** Aeromagnetic series, Harbour Grace, Newfoundland: Canada Geol. Survey Geophysics Paper 4515, scale 1:63,360, 1970.

01001 **Canada Geological Survey.** Aeromagnetic series, St. John's, Newfoundland: Canada Geol. Survey Geophysics Paper 4516, scale 1:63,360, 1970.

01002 **Canada Geological Survey.** Aeromagnetic series, Sandy Narrows, Saskatchewan: Canada Geol. Survey Geophysics Paper 4584, scale 1:63,360, 1970.

01003 **Canada Geological Survey.** Aeromagnetic series, Pelican Narrows, Saskatchewan: Canada Geol. Survey Geophysics Paper 4585, scale 1:63,360, 1970.

01004 **Canada Geological Survey.** Aeromagnetic series, Attitti Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4586, scale 1:63,360, 1970.

01005 **Canada Geological Survey.** Aeromagnetic series, Strange Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4617, scale 1:63,360, 1970.

01006 **Canada Geological Survey.** Aeromagnetic series, Crean Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4618, scale 1:63,360, 1970.

01007 **Canada Geological Survey.** Aeromagnetic series, Montreal Lake South, Saskatchewan: Canada Geol. Survey Geophysics Paper 4619, scale 1:63,360, 1970.

01008 **Canada Geological Survey.** Aeromagnetic series, Whiteswan Lakes, Saskatchewan: Canada Geol. Survey Geophysics Paper 4620, scale 1:63,360, 1970.

01009 **Canada Geological Survey.** Aeromagnetic series, Summit Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4621, scale 1:63,360, 1970.

01010 **Canada Geological Survey.** Aeromagnetic series, Scarth River, Saskatchewan: Canada Geol. Survey Geophysics Paper 4622, scale 1:63,360, 1970.

01011 **Canada Geological Survey.** Aeromagnetic series, Red Bobs Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4623, scale 1:63,360, 1970.

01012 **Canada Geological Survey.** Aeromagnetic series, Erickson Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4624, scale 1:63,360, 1970.

01013 **Canada Geological Survey.** Aeromagnetic series, Pinebluff Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4625, scale 1:63,360, 1970.

01014 **Canada Geological Survey.** Aeromagnetic series, Archibald Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4626, scale 1:63,360, 1970.

01015 **Canada Geological Survey.** Aeromagnetic series, Sheet 37 C/16, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4729, scale 1:63,360, 1970.

01016 **Canada Geological Survey.** Aeromagnetic series, Sheet 37 F/1, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4730, scale 1:63,360, 1970.

01017 **Canada Geological Survey.** Aeromagnetic series, Sheet 37 F/8, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4731, scale 1:63,360, 1970.

01018 **Canada Geological Survey.** Aeromagnetic series, Sheet 37 F/9, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4732, scale 1:63,360, 1970.

01019 **Canada Geological Survey.** Aeromagnetic series, Sheet 37 F/16, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4733, scale 1:63,360, 1970.

01020 **Canada Geological Survey.** Aeromagnetic series, Sheet 37 G/1, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4734, scale 1:63,360, 1970.

01021 **Canada Geological Survey.** Aeromagnetic series, Sheet 37 G/8, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4735, scale 1:63,360, 1970.

01022 **Canada Geological Survey.** Aeromagnetic series, Sheet 37 G/9, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4736, scale 1:63,360, 1970.

01023 **Canada Geological Survey.** Aeromagnetic series, Settee Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4791, scale 1:63,360, 1970.

01024 **Canada Geological Survey.** Aeromagnetic series, Kelly Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4792, scale 1:63,360, 1970.

01025 **Canada Geological Survey.** Aeromagnetic series, Steephill Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4793, scale 1:63,360, 1970.

01026 **Canada Geological Survey.** Aeromagnetic series, Scimitar Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4794, scale 1:63,360, 1970.

01027 **Canada Geological Survey.** Aeromagnetic series, Sheet 63 M/16, Saskatchewan: Canada Geol. Survey Geophysics Paper 4795, scale 1:63,360, 1970.

01028 **Canada Geological Survey.** Aeromagnetic series, Glennie Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4802, scale 1:63,360, 1970.

01029 **Canada Geological Survey.** Aeromagnetic series, Conjuring River, Saskatchewan: Canada Geol. Survey Geophysics Paper 4803, scale 1:63,360, 1970.

01030 **Canada Geological Survey.** Aeromagnetic series, Wintego Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4804, scale 1:63,360, 1970.

01031 **Canada Geological Survey.** Aeromagnetic series, Island Falls, Saskatchewan: Canada Geol. Survey Geophysics Paper 4805, scale 1:63,360, 1970.

01032 **Canada Geological Survey.** Aeromagnetic series, Trade Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4812, scale 1:63,360, 1970.

01033 **Canada Geological Survey.** Aeromagnetic series, Manawan Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4813, scale 1:63,360, 1970.

01034 **Canada Geological Survey.** Aeromagnetic series, Marchel Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4814, scale 1:63,360, 1970.

01035 **Canada Geological Survey.** Aeromagnetic series, Nemei Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4815, scale 1:63,360, 1970.

01036 **Canada Geological Survey.** Aeromagnetic series, Maynard Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4822, scale 1:63,360, 1970.

01037 **Canada Geological Survey.** Aeromagnetic series, Kenny Creek, British Columbia: Canada Geol. Survey Geophysics Paper 5261, scale 1:63,360, 1970.

01038 **Canada Geological Survey.** Aeromagnetic series, Ankwill Creek, British Columbia: Canada Geol. Survey Geophysics Paper 5262, scale 1:63,360, 1970.

01039 **Canada Geological Survey.** Aeromagnetic series, Nilkitkwa River, British Columbia: Canada Geol. Survey Geophysics Paper 5263, scale 1:63,360, 1970.

01040 **Canada Geological Survey.** Aeromagnetic series, Gunanoot Lake, British Columbia: Canada Geol. Survey Geophysics Paper 5264, scale 1:63,360, 1970.

01041 **Canada Geological Survey.** Aeromagnetic series, Kisgegas, British Columbia: Canada Geol. Survey Geophysics Paper 5265, scale 1:63,360, 1970.

01042 **Canada Geological Survey.** Aeromagnetic series, Shedin Creek, British Columbia: Canada Geol. Survey Geophysics Paper 5274, scale 1:63,360, 1970.

01043 **Canada Geological Survey.** Aeromagnetic series, Hilary Lake, British Columbia: Canada Geol. Survey Geophysics Paper 5283, scale 1:63,360, 1970.

01044 **Canada Geological Survey.** Aeromagnetic series, Kotsine River, British Columbia: Canada Geol. Survey Geophysics Paper 5284, scale 1:63,360, 1970.

01045 **Canada Geological Survey.** Aeromagnetic series, Lion Creek, British Columbia: Canada Geol. Survey Geophysics Paper 5285, scale 1:63,360, 1970.

01046 **Canada Geological Survey.** Aeromagnetic series, Ogden Creek, British Columbia: Canada Geol. Survey Geophysics Paper 5286, scale 1:63,360, 1970.

01264 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index sheet 23, Quebec-Newfoundland: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, revised 1970.

01265 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index sheet 67, 77, District of Franklin-District of Mackenzie-District of Keewatin: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, revised 1970.

01266 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index sheet 83, Alberta-British Columbia: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, revised 1970.

01267 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index sheets 94 and 103, British Columbia: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, revised 1970.

01366 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index sheets 48, 58 and 59, 69, 79, District of Franklin: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, revised 1970.

01059 **Carlson, Marvin P.** Lithostratigraphy of the Cambrian in the subsurface of Nebraska [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 379-380, 1970.

08707 **Carpenter, G. L.; Keller, Stanley J.** Oil development and production in Indiana during 1968: Indiana Geol. Survey Mineral Economics Ser., no. 15, 18 p., illus., tables, 1969.

The following are summarized: drilling activity and oil production in Indiana, 1950-68; areas of present and former oil and gas production and locations of important wells drilled in 1968; named stratigraphic units in Indiana showing oil-producing zones and waterflooded zones; and Indiana oil field statistics, 1968.—GV

01319 **Carpenter, Robert H.; Hughes, Thomas C.** Geophysical and geochemical study of the Gladesville Norite in southern Jasper County, Georgia [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s19, 1970.

Carpenter, Robert H. *See* Hughes, Thomas C. 01323

08615 **Carrasco V., B.** Posible importancia económico-petrolera de la brecha litoclástica de la base de la formación El Doctor, en Metztitlan, Hgo.: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 70-72, illus., 1969.

The article describes lithoclastic breccia from the El Doctor formation of the Cretaceous in the Barranca de Cozapa, Hidalgo, Mexico. Reasons are listed for attributing the formation of the breccias to erosion and possible transportation of

limestone fragments previously lithified. The author classifies it as basal breccia since it shows no sedimentary structure. — EH

08642 **Carrasco Velázquez, B.** Petrografía y facies de la secuencia transgresiva-regresiva de las formaciones de Cretácico Inferior y Medio, en Metztitlan, Hgo. [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 91, 1969.

08641 **Carrillo Bravo, J.** Plataforma Valles-San Luis Potosí, Sierra Madre Oriental-Altiplano Mexicano [ABS.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 90-91, 1969.

01196 **Carson, Robert J., 3d.** The Quaternary geology of the south-central Olympic Peninsula, Washington [abs.]: Northwest Sci., v. 44, no. 1, p. 60, 1970.

Carter, Claire. *See* Churkin, Michael, Jr. 08845

01143 **Cartwright, Keros.** Geothermal exploration for ground water — Discussion [of paper by J. H. Birman, 1969]: Geol. Soc. America Bull., v. 81, no. 4, p. 1281-1282, illus., 1970.

In discussion of the above paper by Birman (ibid., v. 80, no. 4, p. 617-630, 1969) Cartwright questions use of "geothermal", and suggests "temperature prospecting" or "temperature exploration" instead. He also finds Birman's discussion of theoretical basis of temperature prospecting unsatisfactory and proposes an alternative. — JHF

01060 **Caspall, Fred C.; Dort, Wakefield, Jr.** Late Pleistocene loess deposits of northeastern Kansas — A preliminary report [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 380-381, 1970.

Cavazos, S. *See* Riva Palacio, E. 08684

08574 **Chapman, Rodger H.** Gravity surveys in California — Recent progress by the California Division of Mines and Geology, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 542-543, illus., 1969.

Work is proceeding on the establishment of a statewide gravity base station network in California and the compilation of a series of gravity maps that will eventually cover the entire state, and local studies related to the search for particular mineral commodities, the location of hidden faults, and other geologic problems. — GV

01134 **Charm, Walter B.** Microfossils and the sea floor: Sea Frontiers, v. 16, no. 2, p. 71-76, illus., 1970.

Research on calcareous nannofossils with the electron and scanning electron microscopes can be considered a new field of study that will in time fill many gaps in the geologic column. The ability to date geologic strata rapidly is of great importance in the oil industry and the realization that these small fossils are excellent stratigraphic indicators has been needed impetus for research. — *from* Author's conclusions

08619 **Chavira, F. C.** Consideraciones sismológicas a la tectónica profunda [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 80-81, 1969.

01145 **Chayes, Felix.** On deciding whether trend surfaces of progressively higher order are meaningful: Geol. Soc. America Bull., v. 81, no. 4, p. 1273-1278, tables, 1970.

To determine whether trend surfaces of progressively higher order are meaningful, the significance test suggested here is a test of the mean square for variation associated with terms only of order $k+1$ against residual dispersion at order $k+1$. Examples are given, using the composition of igneous rocks from Great Britain and the southern California batholith. — AG

Chesser, S. A. *See* Hopkins, E. M. 08468

Childs, Leo F. *See* Badgley, Peter C. 08690

Childs, Leo F. *See* Badgley, Peter C. 08691

08435 **Chmelik, Frank B.; Bouma, Arnold H.; Rezak, Richard.** Comparison of electrical logs and physical parameters of marine sediment cores, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 63-70, illus., 1969.

Spontaneous potential and modified point resistivity logs were made from select cores of marine sediments. The logs have been compared with cone penetrameter and vane shear measurements, shipboard pH and Eh tests, X-ray radiographs and photographs, water content, density, carbonate content and grain size analyses from the same core. Indications are that electrical logs can: (1) be of value in identifying zones of interest which have subtle property differences; (2) be used to correlate from one core to another; and (3) display apparent relationships to other properties. Improvements in instruments and techniques may lead to *in situ* quantitative application of electric logging techniques in all depths of water. — Authors' abstract

01320 **Chowns, T. M.** A chamosite-hematite oolite from the Sequatchie Formation in northwest Georgia [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s19, 1970.

01347 **Christensen, Nikolas I.** Composition and evolution of the oceanic crust: Marine Geology, v. 8, no. 2, p. 139-154, illus., tables, 1970.

Partial melting of mantle peridotite under midoceanic ridges marks the initial stages in the development of the oceanic crust. Tholeiitic magma, which escapes to the ocean floor, forms layer 2. Layer 3, composed of amphibolite and hornblende gabbro, originates beneath the ocean floor by crystallization of tholeiitic magma under hydrous conditions and subsequent metamorphism in the vicinity of ridge crests. Once formed, the oceanic crust is transported laterally by horizontally spreading upper mantle. Disposal of the oceanic crust is accomplished by downward movement in the vicinity of descending limbs of convection cells. Partial melting of the oceanic crust in regions of downward convection results in formation of the calc-alkaline suite of rocks and eclogite. — *from* Author's abstract

08580 **Christensen, Nikolas I.; Bostrom, Robert C.; Crosson, Robert S.** The gravity program of the University of Washington, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 548, 1969.

More than 400 stations have been established with a LaCoste-Romberg geodetic meter in western Washington during the past two years by members of the solid-earth geophysics group with the Geology Department of the University. The surveys have been designed to provide an increased understanding of the crustal structure and tectonics of western Washington. Most of the field work has been completed and data analysis is underway. Results of the investigations included a network of gravity stations in the northern Cascades, a program to re-observe gravity at selected stations to detect strain accumulation, and a gravity program to study the structures of the Twin Sisters Dunite and the Cypress Island Peridotite. — GV

Chronic, John. *See* Goebel, Edwin D. 01073

Churkin, Michael, Jr. *See* Eberlein, G. Donald. 01309

Churkin, Michael, Jr. *See* Brabb, Earl E. 08561

08672 **Churkin, Michael, Jr.; Eberlein, G. Donald; Hueber, Francis M.; Mamay, Sergius H.** Lower Devonian land plants from graptolitic shale in south-eastern Alaska: Palaeontology, v. 12, pt. 4, p. 559-573, illus., 1969.

Drepanophycus sp. and *Hostimella* spp. from Noyes Island are the oldest confirmed land-plant occurrences in the western hemisphere. *Monograptus* aff. *thomasi*, associated with the plants, is Early Devonian, about the same age as undoubted vascular plants in Europe. Corals in interbedded limestones in Alaska further indicate an Early Devonian age. The plant and graptolite shale of Noyes Island is part of a section

composed predominantly of conglomerate, sandstone, and coral limestone breccia, suggesting high-energy shallow marine sedimentation that was interrupted by brief periods of accumulation of graptolitic mud that also preserved fragments of land plants that lived on nearby uplifts. — *from* Authors' abstract

08845 **Churkin, Michael, Jr.; Carter, Claire.** Devonian tentaculitids of east-central Alaska; systematics and biostratigraphic significance: Jour. Paleontology, v. 44, no. 1, p. 51-68, illus., tables, 1970.

Lower Devonian tentaculitids (Mollusca, Cricoconarida) from the Salmontrout Limestone and McCann Hill Chert are described and illustrated. They include one new genus, *Semicyclus*, and 5 new species: *Dicricoconus dutroi*, *D. triannulatus*, *Uniconus orbiculus*, *Semicyclus brabbi*, *Nowakia parabarrandei*. The succession of tentaculitid and graptolite faunas in Alaska is similar to the established zonation in Europe and indicates a precise and reliable long-range correlation (Siegenian to Emsian). — JWH

08651 **Ciesiel, Robert F.; Wagner, Norman S.** Lava-tube caves in the Saddle Butte area of Malheur County, Oregon: Ore Bin, v. 31, no. 8, p. 153-171, illus., 1969.

The chain of tubes and collapse trenches traceable for 8.5 miles in the Saddle Butte lava field was originally one continuous tube, or a closely interrelated system of individual tubes functioning as a unit. This feature formed near the surface of the parent flow without producing a strong reinforcing lining. During their later history, the tubes carried only partial loads of lava. Bulges on the side walls indicate where the level of the stream of draining lava stood at different stages. The thin, fractured, and poorly supported roof has collapsed over long distances. The potential for further collapse is too great to warrant developing as a tourist attraction the few short cave sections that are still fairly safe to enter. Six major caves in the lava field are described, and maps are included. — ESL

Cita, M. B. *See* Peterson, M. N. A. 01371

01359 **Cita, Maria B.; Nigrini, Catherine; Gartner, Stefan.** Biostratigraphy, Chap. 19 *in* Initial reports of the Deep Sea Drilling Project — V. 2, Leg 2 of cruises of *Glomar Challenger*, Hoboken, N. J., to Dakar, Senegal, Oct.-Nov. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 391-411, illus., tables, 1970.

The five sites drilled during Leg 2 yielded 78 sediment cores, mostly highly fossiliferous. Biostratigraphic correlations between holes for the Upper Cretaceous, Tertiary (5 epochs), and Pleistocene are based on Foraminifera, Radiolaria, and nannofossils. The scientists of Leg 2 also attempted to correlate these biostratigraphic sequences with known successions on both sides of the Atlantic. The Eocene-Oligocene and Miocene-Pliocene boundaries are clarified. Some comments are made on paleoenvironments for each age. Eocene Radiolaria recovered during Leg 2 are described and tabulated; 23 are illustrated. — ESL

01181 **Clapham, W. B., Jr.** Nature and paleogeography of middle Permian floras of Oklahoma as inferred from their pollen record: Jour. Geology, v. 78, no. 2, p. 153-171, illus., tables, 1970.

Seventy-one species of terrestrial pollen and spores have been identified in the upper 10-35 feet of the Flowerpot Formation (lower Guadalupian). Study of 62 fossiliferous samples from 46 outcrops shows two distinct assemblages, one characteristic of an upland flora of conifers, and one a salt-marsh or swamp flora dominated by gymnosperms and ferns. The distribution of the two assemblages and of the evaporites and red to black shale and siltstone which comprise the upper part of the Flowerpot indicates general marine transgression, with minor regressions; one widespread dark silty shale unit indicates a brief but extensive major regression. — VES

01304 **Clapham, W. B., Jr.** Permian miospores from the Flowerpot Formation of western Oklahoma: Micropaleontology, v. 16, no. 1, p. 15-36, illus., table, 1970.

The upper Flowerpot Formation of western Oklahoma has yielded 71 species of pollen and spores which occur in two different assemblages. One is the normal Upper Permian assemblage dominated by *Lueckisporites virkkiae*; the other is modified from this by the addition of a high proportion of Sporites. The hypothesis of the latter being reworked from older sediments is discussed and rejected. It is suggested that the spore-rich assemblage represents the expansion of hydrophytic elements present in the flora during certain intervals. Paleoclimatic implications of this are discussed. New genera include *Oklahomaspora*, *Gnetalesaccus*, *Polylophothylax*, and *Paludospora*. New species are described for *Lueckisporites*, *Striatopodocarpotes*, and *Vittatina*. — Author's abstract

01287 **Clark, A. H.** Compositional differences between hexagonal and rhombohedral molybdenite: Neues Jahrb. Mineralogie Monatsh. 1970, no. 1, p. 33-38, 1970.

Experimental and electron microprobe analytical data are presented which suggest that molybdenite-3R is significantly richer in molybdenum than the more widespread 2H-1 modification. Rhombohedral molybdenite is apparently stable in the system Mo-S below approximately 500°C, but is unstable in the presence of pyrite. — Author's abstract

08696 **Clark, John W., Jr.** Implications of land and fresh-water gastropods in archeological sites: Arkansas Acad. Sci. Proc., v. 23, p. 38-52, 1969.

Snails may be used to a limited extent to determine climatic and ecological conditions during the past; they are sensitive to ground level changes and may congregate around sources of lime. In archeological sites some may have been brought in to be eaten, as indicated by radulae found in coprolites and by middens. In using the shells for C-14 dating, snails have been dated as more than twice as old as associated charcoal. Since snails ingest small bits of limestone, they would give an older date than charcoal, because of the fossil calcium carbonates assimilated into the shells. Relative dating must be done with care realizing that fossil snails may be carried into a site, that modern *Rumina* may burrow deeply, and that the larger *Bulimulus* was brought in to eat. Snails in archeological sites, in conjunction with vertebrate and pollen analysis, deserve better treatment than they have hitherto received. — GDC

Clark, Sandra H. B. *See* Foster, Helen L. 01306

Claypool, George E. *See* Baker, Donald R. 01127

01061 **Clayton, Lee.** Bison trails and their geologic significance [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 381, 1970.

01062 **Clayton, Lee; Bailey, Palmer K.** Tundra polygons in the northern Great Plains [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 382, 1970.

Clayton, Lee. *See* Harrison, Samuel S. 01141

08834 **Clifton, H. E.; Mason, R. S.** Black sands, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 102-107, illus., table, 1969.

Investigation and exploitation of black sands in Oregon have been confined mainly to the southwestern coast; other deposits are known in Clatsop County. The heavy sands of beach placers were mined extensively in the 1850's and early 1860's for gold and platinum, and during World War II these sands produced concentrates containing chromite, magnetite, garnet, ilmenite, and zircon. The potential resources of black sands in southwestern Oregon have not been adequately determined. — MHM

01373 **Cohee, George V.; Bates, Robert G.; Wright, Wilna B.** Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1968: U.S. Geol. Survey Bull. 1294-A, p. A1-A55, illus., 1970.

Stratigraphic names adopted, revised, reinstated, or abandoned are listed alphabetically in a table. The age of the unit, the revision, the area involved, the author's

name, and the date of publication of the report are given for each name. Following the table, short papers (cited separately) deal with: newly named and revised Precambrian formations in the Tusas Mountains, northern New Mexico; history of usage of the Portage Formation or Group; a newly named Cenozoic basalt in southeastern Alaska; revision of the Bisbee Group (Lower Cretaceous) in southeastern Arizona; the Tertiary Pantano Formation in southeastern Arizona; members of the Drakes Formation in central Kentucky; and the Paleocene Cantwell Formation in central Alaska. — GVC

08607 **Cole, Gerald A.; Batchelder, George L.** Dynamics of an Arizona travertine-forming stream: Arizona Acad. Sci. Jour., v. 5, no. 4, p. 271-283, illus., tables, 1969.

The limnocrene, Montezuma Well, occupies a circular depression in the Verde Formation in Yavapai County. Water enters from deep, narrow fissures at the bottom, and plunges underground via a "swallet" to the mouth of a cave 60-65 m away and 5 m lower. In a time-of-flow study, chemical analyses at successive stations show minima in specific conductance, filtrable residue, total alkalinity, EDTA hardness, free CO_2 and hydrogen-ion concentration. Loss of $CaCO_3$, precipitated as travertine, amounted to 88.8 kg per day, most of it in the final 20-min, 518-m flow. Diurnal gains in dissolved oxygen could be equated with tremendous losses of free CO_2 — 100 mg per liter in each hour's flow. Calcite equilibrium was exceeded above computed pH. Presence of microparticulate $CaCO_3$ causes a discrepancy between alkalinity and hardness. Soluble silica was lowest at dawn suggesting nocturnal uptake of diatoms. — GDC

01063 **Collinson, Charles.** Geographic variation in Paleozoic conodont faunas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 382, 1970.

01064 **Collinson, Charles; Gross, David L.; White, W. Arthur; Lineback, Jerry A.; Ayer, Nathan J.** Stratigraphy of lacustrine sediments in southwestern Lake Michigan [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 382-383, 1970.

Condie, K. C. *See* Rogers, J. J. W. 01171

08550 **Conolly, John R.; Ewing, Maurice.** Redeposition of pelagic sediment by turbidity currents, a common process for building abyssal plains [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 506, 1969.

Cook, G. *See* Sackett, W. M. 08519

08598 **Cook, Kenneth L.** Gravity surveys in Utah, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 538-541, illus., table, 1969.

Areas of published gravity surveys in Utah are shown in a figure and are numerically keyed to the references. Areas of unpublished surveys in progress are tabulated. The data will be published as quadrangle maps with scales of 1:250,000 and 2-mgal contour intervals. A more generalized gravity map of the state is being prepared on a scale of 1:500,000 with a contour interval of 5-mgal in areas of detailed coverage and 10 mgal in other areas. The principal results of the surveys have been to delineate many Basin and Range fault blocks and to obtain the order of magnitude of minimum total displacement along bounding fault zones, by estimating thickness of valley fill in graben areas. Data are used also to study large-scale features and characteristics of the earth's crust and upper mantle, including isostasy, and to interrelate gravity data with results of refraction seismic studies. — GV

01230 **Cooper, Gustav Arthur.** Stratigraphy of the Hamilton Group of New York [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3705B-3706B, 1970.

08577 **Corbato, Charles E.** Gravity investigation of the Elk Hills (U.S. Naval Petroleum Reserve No. 1), California, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 546, illus., 1969.

A detailed gravity survey is being conducted over the area of the known hydrocarbon reservoirs and the surrounding area of the Elk Hills oil field. An extremely accurate survey is being conducted, results of which will be used for isolation of small anomalies that are possibly attributable to accumulations of petroleum and natural gas. — GV

08724 **Corcoran, R. E.; Walker, G. W.** Geology of the Owyhee Upland province, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 80-83, illus., 1969.

The Owyhee Upland is essentially a plateau developed on several widespread flows and associated pyroclastic and sedimentary rocks of middle to late Cenozoic age. These rocks have been moderately deformed, and block faulting has occurred. Gem-quality chalcedony occurs in this area, and agatized material is known to occur in several places. Small amounts of natural gas have been produced from sands in the Idaho Group. Potential resources include diatomite, pumicite, perlite, optical calcite, salt brines, and bedded potassium feldspar and zeolite deposits. — MHM

08728 **Corcoran, R. E.** Bauxite, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 98-102, illus., table, 1969.

Deposits of high-iron bauxite in northwestern Oregon were discovered in 1943, and other deposits of ferruginous bauxite are known to occur in several widely separated areas along both sides of the Willamette Valley. Total resources of ferruginous bauxite in the State probably exceed 50 million tons. The Oregon bauxites are the most important potential resource of low-silica aluminous raw material in the United States. — MHM

08796 **Corcoran, R. E.** General geologic history of Oregon, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 23-32, 1969.

Oregon is in a zone that has undergone several prolonged periods of severe deformation and recurrent volcanism. Schists, probably early Paleozoic in age, occur along the California border in Jackson County. Emplacement of ultramafic and associated rocks accompanied uplift and folding during the early part of the Mesozoic Era and again in middle and late Mesozoic time. The Cenozoic Era is characterized by marine and continental sedimentary rocks interbedded with tuffaceous sediments and lava flows. — MHM

08765 **Cotter, R. D.; Hutchinson, R. D.; Skinner, E. L.; Wentz, D. A.** Water resources of Wisconsin — Rock-Fox River basin: U.S. Geol. Survey Hydrol. Inv. Atlas HA-360, 4 sheets, scale 1:1,000,000, text, 1969.

Sheet 1 contains a block diagram of the Rock-Fox River basin; maps showing bedrock and glacial geology, and soil permeability; and diagrams of the water cycle and water budget. Sheet 2 contains information on surface water, sheet 3 ground water, and sheet 4 water use. Ground water is available nearly everywhere at depths of less than 150 feet, from four major aquifers: Cambrian to Ordovician sandstones, yields 100-2,000 gpm; Ordovician Platteville-Galena aquifer, 10-100 gpm; Silurian Niagara Dolomite, 0-1,500 gpm; and sand and gravel, 10-5,000 gpm. Ground water is generally of good quality. — MCM

08578 **Couch, R. W.; Heinrichs, D. F.** Oceanic and continental gravity investigations by Oregon State University, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 546-548, illus., 1969.

Since 1962 the Department of Oceanography, Oregon State University, has obtained gravity measurements in the Hawaiian and Aleutian archipelagoes along the continental margin of North America from San Francisco Bay to Cape Spencer (Alaska), and in Oregon. From 1963 through 1968 approximately 37,000 measurements were made in these regions, and provided the basis for construction of gravity

anomaly maps and studies of selected crustal and subcrustal structures. Other surveys include underwater gravity meter measurements in 1962 to establish a nearshore marine gravity range along the north-central Oregon coast near Newport, surface ship gravity measurements west of Oregon in 1963 and over the eastern end of the Mendocino escarpment west of northern California in 1964, and other measurements along the coasts of Alaska, British Columbia, and Washington. Results are discussed. — GV

08656 **Couch, Richard; Whitsett, Robert.** The North Powder earthquake of August 14, 1969: Ore Bin, v. 31, no. 12, p. 239-244, illus., table, 1969.

Geographic coordinates for the epicenter of this earthquake were 44°59' N. and 117°45' W., about 12 km south-southeast of North Powder, Oreg., and 4 km southeast of the Thief Valley Reservoir; focal depth was 32 ± 3 km, and magnitude was 3.6 on the Richter Scale. First motion directions suggest right lateral faulting along a northwest-southeast trending strike-slip fault. The relatively aseismic area is bordered on the east and north by seismically active areas. The earthquake occurred in an area of glacial and fluviatile deposits concentrated in valleys, which may explain the high intensities associated with a deep earthquake. The local depth of the earthquake suggests a regional rather than local cause, and the method of faulting suggests subcrustal tectonics rather than isostatic adjustment. Data indicate that the Moho is at a depth of about 42 km, as previously depicted. — ESL

08800 **Cox, Dennis P.** Map showing citrate-soluble heavy metals in stream sediments, Ossipee Lake quadrangle, Carroll County, New Hampshire: U.S. Geol. Survey Misc. Geol. Inv. Map I-609, scale 1:62,500, text, 1969.

The central part of the Ossipee Lake quadrangle is underlain by mica schists of the Littleton Formation; Ossipee Mts. and other areas by stocks, ring dikes, and volcanic rocks of the White Mts. Pluton Series, most widespread unit being Conway Granite. The Silver Lake vein contains quartz, galena, sphalerite, calcite, hematite, chlorite, and minor amounts of other minerals. Geochemical analyses of 602 samples of stream-channel sediment show those collected in two largest areas underlain by Conway Granite and in the intervening western area gave higher values of heavy metals than those from the main eastern area. In western samples 4.5 percent exceed 29 ppm, in eastern, 4.5 percent exceed 17 ppm; these may be considered anomalous. It is suggested that the Conway Granite is the source of the mineral deposits; four groups or clusters of anomalous samples are directly related to obvious surface expressions of mineralization. — MCM

Cramer, Fritz H. *See* Andress, Noel E. 08463

Cramer, Fritz H. *See* Goldstein, Robert F. 08525

01381 **Crane, H. R.; Griffin, James B.** University of Michigan radiocarbon dates XIII: Radiocarbon, v. 12, no. 1, p. 161-180, 1970.

The list of dates compiled since List XII includes geologic samples from Michigan and South Africa; and archeologic samples from the United States, Mexico, Central America, South America, Africa, Europe, the Near East, and Asia. — MCM

01065 **Cranson, K. R.; Yarger, Richard D.** Field laboratories in introductory physical geology [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 383, 1970.

01269 **Crompton, A. W.; Hiiemae, Karen.** Molar occlusion and mandibular movements during occlusion in the American opossum, *Didelphis marsupialis* L.: Linnean Soc. Zool. Jour., v. 49, no. 1, p. 21-47, illus., 1970.

The dentition of the American opossum has been examined, using prepared skulls, occlusal casts, and cinefluorography of jaw movements during normal chewing; from this information, the power stroke of mastication is simulated on a stereotaxic machine. Two types of power stroke are described: a crushing, puncturing stroke with tooth-food-tooth contact in early stages of mastication, and a shearing stroke

with tooth-tooth contact occurring later. The first type flattens tips of the molar cusps, the second produces striated wear facets on slopes of the cusps. The opossum has retained essentially the same tribosphenic molars as found in Cretaceous therians *Pappotherium*, *Holoclemensia*, *Alphadon*, from which the molars of all later therians appear to be derived; it is suggested that the power stroke and occlusion is also essentially the same. — VMJ

01066 **Crosby, Percy.** Major element variation across an Adirondack anorthosite-charnockite contact [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 383-384, 1970.

Crosson, Robert S. *See* Christensen, Nikolas I. 08580

08436 **Culbertson, Verne L.** Let's improve our Wilcox success ratio! — Exploration problems of the Wilcox (Eocene) trend of southwestern Mississippi, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 71-88, illus., 1969.

For the past three years exploratory success in the Eocene Wilcox Formation of southwestern Mississippi has averaged 6.7 percent, far below the success of 1951-53. If we are to reverse this trend, the geologist must improve sampling and testing procedures in the field and more effectively utilize well data in office and laboratory. Serious errors in elevations and well locations, deviated hole problems, inadequate sampling of wildcat wells, and incomplete evaluation of oil shows have all contributed to an excessive number of dry holes. The present success ratio can be improved by greater use of isopachs to supplement structural contouring, better understanding of the relationship of oil to regional subsidence and remigration, and more careful evaluation of core analyses to differentiate between live oil and residual oil. — *from* Author's abstract

01150 **Culler, R. C.** (and others). Objectives, methods, and environment — Gila River Phreatophyte Project, Graham County, Arizona: U.S. Geol. Survey Prof. Paper 655-A, p. A1-A25, illus., 1970.

One method of conserving water in the Southwest is to replace phreatophytes by useful vegetation. The Gila River Phreatophyte Project was begun in 1962, to evaluate this in a typical floodplain by defining hydrologic and ecologic variables. In the 15-mile reach in the San Carlos Indian Reservation, about 6,000 acres are covered by phreatophytes, principally saltcedar and mesquite; their removal was started in the upper subreach in 1966 and the middle and lower subreaches in 1967. Postclearing measurement will extend to July 1972. To compute evapotranspiration as a residual, the chief method is a water budget that includes surface and subsurface inflow and outflow, precipitation on the flood plain, and changes in ground-water storage in saturated and unsaturated zones. Also being studied are chemical quality of water, climate, sedimentation, and vegetation. Three of the 11 papers by various contributors are cited separately. — GDC

08792 **Cuppels, Norman P.** Surficial geologic map of the Georgetown quadrangle, Essex County, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-850, scale 1:24,000, text, 1969.

Surficial deposits in the Georgetown quadrangle consist of Wisconsin glacial deposits and Holocene swamp and salt-marsh deposits; till, the oldest, generally underlies all other deposits. Glaciofluvial deposits are collapsed stratified drift, and outwash in the Ipswich and Parker Rivers areas; glaciomarine deposits are marine and estuarine clay and sand. Glacial deposits are the product of the Laurentide Ice Sheet that covered all of New England except parts of Martha's Vineyard and Nantucket Island. Although sand and gravel pits are abundant, many have been abandoned because of zoning laws enforced by several towns. Marine clay is a potential source of lightweight aggregate. — MCM

Cvancara, Alan M. *See* Bickley, William B., Jr. 01055

08515 **Dahlem, D. H.; Bailey, N. G.** Oral geologic descriptions — Their quick-time storage and retrieval [abs.], *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 950, 1969.

01067 **Dapples, E. C.** Environments influencing deposition of the Franconia Formation [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 384, 1970.

01183 **Dasgupta, H. C.** Influence of temperature and oxygen fugacity on the fractionation of manganese between coexisting titaniferous magnetite and ilmenite: Jour. Geology, v. 78, no. 2, p. 243-249, 1970.

Concentration of Ti in titaniferous megnetite (X^{Mt}_{Ti}) influences the activity of Mn in that mineral and thereby affects K^{Mn}_{D}. The observed relations indicate that K^{Mn}_{D} is controlled primarily by temperature. The relation between oxygen fugacity and T of a wide variety of plutonic and igneous rocks is expressed by a formula given here. The slope reveals that the range of oxygen fugacity is severely restricted by T. This further implies that K^{Mn}_{D} is temperature dependent. — *from* Author's abstract

08507 **David, Michel.** The notion of "extension variance" and its application to the grade estimation of stratiform deposits, *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 63-81, illus., 1969.

One of the most important questions that arises in ore estimation can be stated as follows: What is the error when one extends the grade of a sample to a certain volume? The theory of regionalized variables, with the concept of extension variance, provides a response to that crucial question for any kind of sample extended to any volume. For the usual "extensions" encountered in current mining practice, some simple results can be derived from that theory which was initiated by Dr. G. Matheron. These results have been applied to a stratiform lead-zinc deposit for which several estimations of grade, tonnage and related precision have been made for a series of grid sizes such as might be used in a progressive exploration program. — Author's abstract

08702 **Davis, C. E.; Holdridge, D. A.** Quantitative estimation of clay minerals by d.t.a.: Clay Minerals, v. 8, no. 2, p. 193-200, tables, 1969.

Studies were conducted on the feasibility of using the Dupont 900 thermal analyzer for quantitative estimation of clay minerals. The results indicate that kaolinite, gibbsite, goethite and calcite can be determined quite accurately and in small concentrations provided there are no serious interferences. Quartz in excess of 5 mg or more can be determined with a reasonable degree of accuracy. Approximate estimates of montmorillonitic contents of soil clays can be made by measuring the areas of the low temperature endotherms of samples which were equilibrated over saturated $Mg(NO_3)_2$. — Authors' abstract

Davis, E. Mott. *See* Valastro, S., Jr. 01340

01369 **Davis, Fenelon F.** (and others). Some highlights of 1969, California mining review: California Div. Mines and Geology Mineral Inf. Service, v. 23, no. 4, p. 67-78, illus., 1970.

This review of mining and the minerals industry in California for the first 10 months of 1969 encompasses copper, gold, iron ore, mercury, silver-lead, tungsten, asbestos, borax, cement, coal, diatomite, geothermal resources, gypsite, jade, limestone, phosphates, rock products, salt, talc, wollastonite, oil, and natural gas. — MCM

01129 **Davis, John Clements.** Petrology of Cretaceous Mowry Shale of Wyoming: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 3, p. 487-502, illus., table, 1970.

The Mowry Shale, a dark siliceous Lower Cretaceous shale exposed in Wyoming and parts of adjacent states, includes four facies: siliceous shale, silty shale, sandstone, and

cristobalite shale. The mineral constituents of the Mowry, determined by X-ray diffraction, average 50 percent quartz, 5 percent feldspar, and 2 percent organic carbon. The rest of the rock is predominantly mixed-layer clay minerals. Mineral-distribution patterns suggest that the Mowry is a transgressive clastic unit similar to other Cretaceous fine-grained deposits in the Rocky Mts. Excess silica and organic carbon were derived from tests of Radiolaria and other planktonic organisms that proliferated in a restricted terminus of a boreal seaway. Deposition of the formation ceased when the boreal seaway became connected to the Gulf sea. — *from* Author's abstract

08698 **Davis, Leo Carson.** The biostratigraphy of Peccary Cave, Newton County, Arkansas: Arkansas Acad. Sci. Proc., v. 23, p. 192-196, illus., 1969.

In this cave at the bottom of a 32-ft pit in Ordovician limestone, bones of an extinct peccary and cave formations prompted further excavation. In one trench profile, alluvial fill contains bones, gravel, peccary droppings and thin limestone layers, beneath which limestone blocks of a single fall overlie granular red and yellow clays containing scattered calcite and few bones. *Platygonus compressus* must have persisted far past the 11,000-yr date usually accepted for its extinction; its droppings were found a foot higher and 2 to 3 feet horizontally displaced from charcoal dated at 4290 years. Farther within the cave, differing layers indicate climate change, and remains of other extinct animals as well as of extant species. The original entrance has not been definitely located. Mollusks in the cave fill are identical to black shells in Imo Shale of Mississippian age on a nearby hill. — GDC

01068 **Davis, Richard A., Jr.** Beach dynamics in southeastern Lake Michigan [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 384-385, 1970.

Dawson, T. A. *See* Becker, Leroy E. 01052

Deal, Dwight E. *See* Moran, Stephen R. 01091

deAlvarez, G. *See* Tellez, C. 08679

01385 **Deep Sea Drilling Project.** (East Coast Repository). Carbon carbonate results, [Chap.] 9 *in* Initial reports of the Deep Sea Drilling Project — V. 2, Leg 2 of cruises of *Glomar Challenger*, Hoboken, N. J., to Dakar, Senegal, Oct.-Nov. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 319-321, tables, 1970.

Methods used in determination of total carbon, organic carbon, and calcium carbonate percentages were described in the Leg 1 cruise report. Sediments sampled in Leg 2 were mainly either high-carbonate marl or chalk oozes, or clays with low-to-zero carbonate. Complete carbon-carbonate results and average carbon contents of sediments from Leg 2 are tabulated. — ESL

08533 **Deep Sea Drilling Project.** (East Coast Repository). Grain size analysis, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 325-333, illus., tables [1969?].

Methods used in analyzing deep-sea sediments are based on standard procedures, and consist of dispersing the sediment in Calgon solution, using an ultrasonic probe, sieving the sand fraction, and pipetting the silt and clay fractions. Complete results are given as Table 1, and breakdown of the coarse fraction as Table 2. Triangle diagrams based on results for each site are given; cores are described by sites. — ESL

08534 **Deep Sea Drilling Project.** (East Coast Repository). Water content results, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of the Drilling Vessel *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 334-339, illus., table [1969?].

Two-cubic centimeter samples were taken from each core and frozen; the frozen samples were used for shore-based determination of water content. A complete list of

the results is tabulated, and a plot of percentage water content against depth below sea floor surface is included. Results are described also by sites. — ESL

08535 **Deep Sea Drilling Project.** (East Coast Repository). Carbon carbonate results, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 340-347, illus., table [1969?].

The total amount of carbon and of organic carbon was determined on a carbon analyzer. Using the formula: percent total carbon minus percent organic carbon multiplied by 8.33, the percent of calcium carbonate in the sample was calculated. Complete carbon and calcium carbonate analyses are tabulated, and a scatter diagram to illustrate distribution of carbonate within the sediments is included. Results are described by sites. — ESL

08622 **delaFuente Mejía, I.** Problemas de la exploración petrolera de la Cuenca de Chicontepec [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 82, 1969.

08516 **Demeter, E. J.** Basic requirements for computer-oriented information flow in mineral exploration [abs.], *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 951, 1969.

08529 **Dengo, Gabriel.** Problems of tectonic relations between Central America and the Caribbean, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 311-320, illus., 1969.

From Late Jurassic to early Tertiary the geologic history of northern Central America can be correlated with the Mexican geosyncline and to an extent with the Greater Antilles. Southern Central America and large portions of the Greater Antilles represent oceanic basement that originated in Mesozoic and should not be considered in pre-Mesozoic reconstruction. Emplacement of most circum-Caribbean serpentinites and definition of large fault zones that limit the Caribbean Sea on the north and south were major regional features defined during or shortly after the Laramide deformation, although some few originated in earlier tectonic events. Post-Laramide tectonics were controlled by a stable Caribbean divided in small crustal blocks, separated by large faults. Late Tertiary tectonics of Central America are related to the eastern slope of the East Pacific Rise. — *from* Author's abstract

Dennison, John M. *See* Textoris, Daniel A. 01179

08841 **deQuervain, Marcel.** (and others). Schneekundliche Arbeiten der Internationalen Glaziologischen Grönlandexpedition (Nivologie): Medd. Grönland, v. 177, no. 4, 283 p., illus., tables, 1969.

This report deals with snow research by the International Glaciological Expedition in Greenland in 1959-60. After description of operations and topography in the working areas, chapters 6-12 deal with measurements of accumulation across central Greenland, from Camp VI EGIG to Station Jarl-Joset, firn stratigraphy, and study of deformation of the nevé crust to depths of 40 m in the Dumont (1957) shaft. A slight temperature decrease at a depth of 20 m suggests a colder period about a century ago. Evaporation was not an important factor in the mass balance. Strong variations of summer temperature gradient in the uppermost layer provoke a high rate of "constructive metamorphism" even without melting. Preferred orientation of the C-axis, shown in thin sections of firn from the shaft, was attributed to snow drift direction rather than a rheological process. — *from* Author's abstract

08808 **Deul, Maurice.** Limestone in mine drainage treatment: Mining Cong. Jour., v. 55, no. 11, p. 88-91, illus., 1969.

The problem of treatment of acid mine water to produce a final effluent having a pH between six and nine, and less than seven ppm iron is examined. Lime or limestone neutralization are the only practical options; they react with sulfuric acid and iron

phosphate to yield slightly soluble calcium sulfate and insoluble hydrated iron oxides. Drainage control reduces treatment cost and mines should be designed taking this into account, minimizing roof fracturing and subsidence. Worked out areas may be inundated. — ESL

Dewey, John F. *See* Bird, John M. 01137

01308 **deWitt, Wallace, Jr.** Reasons for abandonment of the Portage Group, *in* Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1968: U.S. Geol. Survey Bull. 1294-A, p. A23-A25, 1970.

Dickau, Bruce E. *See* Puri, Harbans S. 08521

08522 **Dickinson, Kendell A.** Upper Jurassic carbonate rocks in northeastern Texas and adjoining parts of Arkansas and Louisiana, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 175-187, illus., tables, 1969.

Except for the Smackover, carbonate rocks form a small part of the Upper Jurassic sequence, but they are widespread and are sensitive indicators of environments of deposition and are important in correlation. Rocks of Late Jurassic age include in ascending order, the Smackover and Buckner Formations and the Bossier and Schuler Formations of the Cotton Valley Group, now at depths from 3,000 to 12,000 feet. The Smackover Formation has three informal members, the lower deposited in deep, possibly stagnant basin, and the upper two deposited in shallower parts of the basin margins. The Buckner Formation has two members, the lower mostly anhydrite and anhydritic mudstones deposited in an evaporitic basin and mudflats, and the upper mostly nodular anhydritic mudstone deposited in evaporitic mudflats. The Bossier is an offshore equivalent of the Buckner and parts of the Smackover and Schuler Formations, and the Schuler includes marine and nonmarine facies consisting mostly of mudstone, shale, and sandstone with some limestone in marine facies. — VSN

Dickman, John T. *See* O'Dette, Ralph E. 08513

08509 **Dixon, Colin J.** The machine representation of geological information, *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 283-303, illus., 1969.

This paper describes some of the basic notions of project "GEOSEMANTICA 70," the aim of which is to devise means of storing real geological information in a machine rather than the representation of the information in human language form. This is seen as the only long-term solution to the problems of the complex vocabulary of geology and complex syntax of geological description. Effectively, a machine language is being defined, consisting of a set of symbols and a data structure for representation of geological and related information; beyond this is the definition of a set of rules allowing the use of constrained text as an input/output medium. The investigation is oriented primarily to the representation and handling of information about mineral deposits and associated geographic, economic and engineering information. — *from* Author's abstract

01069 **Dodd, J. Robert; Stanton, Robert J., Jr.** Combined faunal and biogeochemical analysis in paleoecology — An example [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 385, 1970.

Dole, H. M. *See* Weissenborn, A. E. 08726

08716 **Dole, Hollis M.; Weissenborn, A. E.** Geology and mineral resources — Introduction, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 15-23, illus., 1969.

The State is divided into ten geomorphic sections: Western Oregon, Klamath Mountains, Cascade Range, Deschutes-Umatilla Plateau, Joseph Upland, Blue Mountains, Snake River Canyon, High Lava Plains, Owyhee Upland, and Basin and Range.

Geologic and topographic mapping and geophysical and geochemical studies of the State are described briefly. The geology of each section and the principal mineral resources are summarized to provide background data for the remainder of the report. References are cited, and a small-scale geologic map of Oregon is included. — MHM

08464 **Downing, Daryl P.** A list, bibliography, and index of the fossil vertebrates of Louisiana and Mississippi, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 385-423, 1969.

Species of fossil vertebrates reported from Louisiana and Mississippi are listed. The bibliography consists of 167 titles and contains detailed annotations on vertebrates from those states. Both systematic and chronologic-geographic indexes are provided. — Author's abstract

Dort, Wakefield, Jr. *See* Caspall, Fred C. 01060

01070 **Dort, Wakefield, Jr.** Multiple early Pleistocene tills, loesses, and soils, Doniphan County, northeasternmost Kansas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 385-386, 1970.

Dorta, Clara C. *See* Rona, Elizabeth. 08527

Douglas, Richard F. *See* Robertson, David S. 08805

Doyle, Larry J. *See* Pilkey, Orrin H. 08438

01282 **Drake, John C.** Mineralogical relationships in Seymour, a coarse octahedrite: Meteoritics, v. 5, no. 1, p. 19-31, illus., 1970.

Seymour, a coarse octahedrite weighing 24.5 kg, contains two types of troilite-graphite nodules (massive graphitic nodules with irregular troilite rims, and troilite nodules with irregular, partial or total, rims of graphite); four morphologically distinct types of phosphide (lamellar, swathing, grain boundary, and rhabdite); and three types of cohenite (lamellar, swathing, and inclusions in kamacite). It is believed that lamellar and swathing schreibersite crystallized from taenite at approximately 900°C, followed by the crystallization of kamacite, then the development of cohenite, and finally a second period of phosphide nucleation giving rise to grain boundary schreibersite and rhabdite. Compositional data indicates that grain boundary schreibersite and rhabdite grew simultaneously. —*from* Author's abstract

01071 **Druce, Edric.** Upper Paleozoic conodont distribution [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 386, 1970.

Duncan, Floyd R. *See* Tackett, Stanford L. 01283

Duncan, J. R. *See* Griggs, G. B. 01349

01122 **Duncan, John R.; Kulm, L. D.; Griggs, G. B.** Clay mineral composition of late Pleistocene and Holocene sediments of Cascadia Basin, northeastern Pacific Ocean: Jour. Geology, v. 78, no. 2, p. 213-221, illus., 1970.

Systematic lateral and vertical trends in proportions of clay minerals can be recognized in Pleistocene and Holocene lutites outward from the mouth of the Columbia River. In Holocene sediments, the percentage of chlorite and, to a lesser extent, illite, increases outward; the montmorillonite content decreases outward. Late Pleistocene deposits always contain less montmorillonite and more illite than Holocene deposits, but show similar lateral variations. The abrupt change in clay mineral proportions at the Pleistocene/Holocene boundary probably reflects abundant illite-rich assemblages glacially eroded in the upper Columbia basin during the Pleistocene, and montmorillonite-rich clays from the lower Columbia and Snake River basins after the close of glaciation. — ETR

01217 **Dunn, D. L.** Middle Carboniferous conodonts from western United States and phylogeny of the platform group: Jour. Paleontology, v. 44, no. 2, p. 312-342, illus., 1970.

Conodonts from eight sections of Late Mississippian (Chester) and Early Pennsylvanian (Morrow) rocks in Texas, Oklahoma, Utah, and Nevada were studied. More than 50 species of conodonts are described and illustrated, including two new Pennsylvanian species, *Adetognathus inflexus* and *Ozarkodina spatula*. Some common Pennsylvanian species of Gnathodus are assigned to a new genus, *Neognathodus*. It is concluded that the Pennsylvanian platform genera were derived from the Late Mississippian *Gnathodus girtyi*, *Adetognathus unicornis* and *Gnathodus commutatus commutatus* stocks. — JWH

01289 **Duplessy, J. C.; Lalou, C.; Vinot, A. C.** Differential isotopic fractionation in benthic foraminifera and paleotemperatures reassessed: Science, v. 168, no. 3928, p. 250-251, illus., table, 1970.

Different species of benthic Foraminifera taken at the same level in an Atlantic core yielded different oxygen isotopic values. It was therefore impossible to deduce paleotemperature values. In addition, pelagic and benthic species showed the same isotopic variations, an indication that pelagic and benthic species reflect only the variation of oxygen-18 composition of the ocean. — Authors' abstract

01226 **Dyck, John Henry.** The detection of subsurface resistive zones — A study of groundwater geophysics in Saskatchewan [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3639B-3640B, 1970.

01136 **Dymond, Jack.** Excess argon in submarine basalt pillows: Geol. Soc. America Bull., v. 81, no. 4, p. 1229-1232, illus., table, 1970.

Four deep-sea basalt pillows from near the axis of the East Pacific Rise were investigated for the presence of excess radiogenic argon. Excess argon in the rocks is verified by the presence of an argon gradient. The highest concentrations of radiogenic argon occur in the pillow margins, and at depths of 5 to 8 cm within the pillows, no radiogenic argon can be measured. The complete degassing of the insides of deep-sea pillow basalts suggests that K-Ar ages of deep-sea rocks may be valid if large samples are used. — Author's abstract

08829 **Eaton, J. P.** Tectonics of the San Andreas fault system — Seismological studies [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 379, 1969.

Heaviest concentrations of foci in central California are along the Sargent fault west of Gilroy, and along the San Andreas fault west of Hollister. Aftershocks of the 1966 Parkfield-Cholame earthquake are concentrated in a long, narrow, nearly vertical zone, to depths of 12 to 15 km. — KAF

01309 **Eberlein, G. Donald; Churkin, Michael, Jr.** Tlevak Basalt, west coast of Prince of Wales Island, southeastern Alaska, *in* Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1968: U.S. Geol. Survey Bull. 1294-A, p. A25-A28, illus., 1970.

Eberlein, G. Donald. *See* Churkin, Michael, Jr. 08672

Edgar, N. T. *See* Peterson, M. N. A. 01360

Edgar, N. T. *See* Peterson, M. N. A. 01371

08597 **Edgar, Robert A.** Earth Science (ESCP) at Maryvale High School, Phoenix, Arizona [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 50-51, 1969.

08828 **Edwards, Jonathan, Jr.** Mineral resources of Harford County, *in* The geology of Harford County, Maryland: Baltimore, Md., Maryland Geol. Survey, p. 104-111, illus., 1969.

Crushed stone and sand and gravel are the principal commodities currently produced in Harford County; metallic and nonmetallic minerals, such as iron, chromite, feldspar, quartz, and asbestos, are of historic interest but no longer produced. Increasing demand for construction materials is indicated, for which many of the underlying metamorphic rocks are suitable; best sources for crushed stone are the James Run Gneiss, metagabbro near Aberdeen, and possibly northern bodies of serpentine, also used for decorative stone. Available areas of suitable sand and gravel, both Cretaceous and Tertiary, are not extensive and many are preempted by other land use. Quaternary sands, silts and clays do not contain economic deposits of gravel; most of that land is occupied by Federal military installations. Localities of all known mines, quarries, pits and prospects are indicated on a map. — GDC

01301 **Eicher, Don L.; Worstell, Paula.** *Lunatriella*, a Cretaceous heterohelicid foraminifer from the western interior of the United States: Micropaleontology, v. 16, no. 1, p. 117-121, illus., 1970.

Lunatriella spinifera, n.gen., n.sp., a small heterohelicid foraminifer of inferred planktonic habit, is characterized by irregularly uniserial late chambers which commonly bear single spinelike projections, and by distinctive troughlike flanges extending below the aperture. An associated small species referred with some reservation to *Heterohelix pulchra* (Brotzen) is believed to be its immediate ancester. *L. spinifera* occurs in strata of early Turonian age belonging to the upper part of the Greenhorn Formation and the lower part of the Carlile Shale. It is represented by about 200 specimens from six localities in South Dakota, Kansas, and Colorado. — Authors' abstract

Eisenberg, A. *See* Bolt, Bruce A. 08774

01135 **Eitel, Dean F.; Yeager, Joan E.; Holmes, Robert F.; Footen, Joseph J.** (compilers). Selected bibliography of the terrain sciences (4th edition): Alexandria, Va., Raytheon Co., 96 p., 1970; originally published 1967.

The 925 references in this bibliography are in nine sections: geology, geomorphology, soils, vegetation and land use, hydrology and oceanography, engineering and photogrammetry, color, multisensor, and general studies and reference textbooks. Appendices contain a list of abbreviations, issuing organizations and addresses, and an author index. — MCM

Elorduy Téllez, E. *See* Bello Orta, G. 08630

08551 **Elsik, William C.** Late Neogene palynomorph diagrams, northern Gulf of Mexico, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 509-528, illus., 1969.

The cyclic nature of Late Neogene climate is reflected in the relative frequency diagrams of palynomorphs deposited in the northern Gulf of Mexico. A general cooling through the Late Neogene and at least five glacial cycles for the Quaternary are indicated. An additional prominent cold cycle in latest Miocene time is interpreted from the frequency diagram of *Picea*, spruce. The Pliocene-Pleistocene boundary is marked by an abundance of *Ambrosia* and *Helianthus* types of Compositae pollen below and increased frequency of *Alnus* and *Exesisporites* above. The fungal spore *Exesisporites neogenicus*, n. gen., n. sp., occurs abundantly in the lower part of the Pleistocene and again lower in the Neogene. — Author's abstract

01363 **Emmett, William W.** The hydraulics of overland flow on hillslopes: U.S. Geol. Survey Prof. Paper 662-A, p. A1-A68, illus., tables, 1970.

Overland or sheet flow from rainfall on hillslopes responds to downslope increase in discharge by increasing its depth and velocity. A theoretical model was based on most probable statistical concepts. In field verification of laboratory experiments, seven sites in Sublette County, Wyo., were investigated for effects of ground surface, slope profile, and sedimentation. Comparison of field and laboratory data illustrates the extreme influence of vegetation and topographic irregularities on resistance to flow on natural hillslopes. The model, in general agreement with measured data on

downslope increase in depth and velocity, further shows that, with no constraint, slope for laminar flow increases and for turbulent flow decreases downslope, and mixed flow has a generally constant downslope gradient. This requires convex upper, straight middle, and concave lower segments — the profile most often found in nature. — GDC

Emond, Pierre L. *See* Morency, Maurice. 01204

01358 **Engel, A. E. J.; Engel, C. G.** Igneous rock samples recovered on Leg 2, [Chap.] 18 *in* Initial reports of the Deep Sea Drilling Project — V. 2, Leg 2 of cruises of *Glomar Challenger*, Hoboken, N. J., to Dakar, Senegal, Oct.-Nov. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 387, 1970.

Three specimens of basalt and diabase were recovered in two holes on the Mid-Atlantic Ridge. Both of the sills cored seem to be oceanic tholeiites, based on examination with a hand lens and in thin section. All cores are vesicular and incipiently-to-highly-altered, especially to palagonite and carbonate. The glassy upper sill margins are almost completely replaced by palagonite in places; zoning is described. This alteration plus the fact that none of the material is entirely fresh may make rock analyses and age determinations only approximate. The presence of vesicles suggests either emplacement at shallower depths, or different fluids and fluid pressures than commonly assumed for magmas at these depths. — ESL

Engel, C. G. *See* Engel, A. E. J. 01358

England, J. H. *See* Andrews, J. T. 01251

08793 **Englund, Kenneth J.** Geologic map of the Jellico West quadrangle, Kentucky-Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ-855, scale 1:24,000, section, text, 1969.

Coal mining in the Jellico West quadrangle is mainly a strip operation in the Swamp Angel (largest reserves, average thickness 30 in.), Rex (average 32 in.), Dixie (thin and mined locally), Blue Gem (high quality coal, relatively thin), Jellico (widely mined), Lick Fork (18-22 in. thick), Elk Gap, Upper Pioneer, Windrock, Big Mary, and Braden Mountain beds. Remaining recoverable reserves are estimated as 123 million tons. Shale and clay beds in the Hance Formation have been used in the manufacture of bricks. Limestone, sandstone, oil and natural gas are potential mineral resources that lack commercial development. — MCM

08694 **Enos, Paul.** Cloridorme Formation, Middle Ordovician flysch, northern Gaspé Peninsula, Quebec: Geol. Soc. America Spec. Paper 117, 66 p., illus., tables, geol. map, 1969.

Cloridorme Formation is proposed as a new name to replace time-stratigraphic usage of Nornamskill for upper Middle Ordovician rocks of northern Gaspé Peninsula. The stratigraphy is well exposed along the coast, in three structural blocks bounded by a major fault which accompanied Taconian orogeny. Argillite lithologies recur in several units, but alternating terrigenous clastic and clastic carbonate-rich wedges permit definition of 14 members. Abundant sedimentary structures and reworked benthonic fossils indicate turbidity-current deposition of graywacke, calcisiltite, and calcareous wacke. Current directions were longitudinal from the east except in the upper two members. Indicated source of terrigenous material was in Cambrian and Lower Ordovician geosynclinal rocks to the south. The carbonate source is inferred to have been closer and only partly isolated from the terrigenous. — GDC

01231 **Enright, Richard Louis Charles, Jr.** The stratigraphy, micropaleontology, and paleoenvironmental analysis of the Eocene sediments of the New Jersey Coastal Plain [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3706B, 1970.

Erickson, Barrett H. *See* Malahoff, Alexander. 08581

Ernst, W. G. *See* Seki, Y. 08714

01247 **Esfandiari, Bijan.** Geochemistry and geology of helium [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3787B, 1970.

Estes, Ernest L. *See* Pilkey, Orrin H. 08438

08779 **Evans, David M.** Fluid pressure and earthquakes [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 387-388, 1969.

Investigations are reviewed which support the proposal that increased pore pressure caused by disposal of wastes in the Rocky Mountain Arsenal well caused a series of earthquakes in the Denver area. In tectonically active areas such as along the San Andreas fault the pore-pressure effect might be used to relieve built up stresses. — KAF

01128 **Evans, W. E.** Imbricate linear sandstone bodies of Viking Formation in Dodsland-Hoosier area of southwestern Saskatchewan, Canada: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 3, p. 469-486, illus., 1970.

Viking Formation (Lower Cretaceous) members show a WSW-ENE linearity and southward imbricate overlapping by the younger members. Deposition from east-flowing tidal currents in a far-from-shore marine environment accounts for the unusual orientation which is at a high angle to shore and offshore-bar Viking deposits. Southward migration of the currents, possibly due to changes in submarine topography by older deposits, may account for the small-scale diachronism. Commercial oil and gas reservoirs are in three Viking members. Their depositional patterns seem unrelated to present structure, which may have resulted from compaction-drape of post-Viking beds and solution collapse of Devonian evaporite beds. — EGS

08532 **Ewing, M.; Worzel, J. L.; Beall, A. O.; Berggren, W. A.; Bukry, D.; Burk, C. A.; Fischer, A. G.; Pessagno, E. A., Jr.** Shipboard site reports, Pt. 1 *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 10-317, illus. [1969?].

The first three drilling sites were in the Gulf of Mexico, just below Sigsbee scarp, on the Challenger knoll, and in Sigsbee deep. Four and five were located between Hatteras abyssal plain and the Bahama platform; six and seven, on the west flank of the Bermuda Rise. A number of cores were drilled from each site. Gamma-ray, gamma-gamma, and resistivity logs were run. All cores are described and shown graphically and in photographs. Sediments in the Gulf range in age from Miocene to Pleistocene; those in the Atlantic, from Cretaceous to Pleistocene, with site 5 reaching the Jurassic. Foraminifera are listed from most cores, and Radiolaria from site 4. All cores show some evidence of turbidity currents. — ESL

Ewing, Maurice. *See* Conolly, John R. 08550

Eyl, B. *See* Bonatti, E. 08475

08442 **Fagg, Clint F.; Herlihy, Daniel E.** Profile analysis — A geologically oriented gravity interpretation, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 143-153, illus., 1969.

A byproduct of the examination of three different analytical methods of reducing gravity data to a form useful to the geologist is the presentation of the local gravitational field of one complete quadrangle in the Jurassic trend of Mississippi. The major salt dome minima are qualitatively confirmed by all three methods, although the quantitative effects vary. The more subtle effects of the Jurassic features are more susceptible to distortion by the process of removing the influence of regional density changes. The least distorting method of regional removal is shown to be the interlocking profile network. This technique obtains the most definitive resolution of the local gravitational effects of deep, low volume structures. — Authors' abstract

01255 **Faill, Rodger T.; Wells, Richard B.** A fault near Hazelton: Pennsylvania Geology, v. 1, no. 5, p. 1-2, illus., 1970.

This is a brief description of a fault exposed in a roadcut five miles south of Hazelton in the central anthracite region of Pennsylvania. — MCM

01187 **Farrand, William R.** Revision of the Valders drift border of the Lake Michigan lobe [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 387, 1970.

Fatt, Irving. *See* Kumar, J. 01272

Faure, G. *See* Misra, A. 01185

08849 **Featherstonhaugh, G. W.; White, George W.** (editors). The Monthly American Journal of Geology and Natural Science, *conducted by* G. W. Featherstonhaugh — V. 1 (Facsimile of the 1831-32 edition): New York and London, Hafner Publishing Co. (Contributions to history of geology, V. 3), 576 p., illus., 1969.

The twelve issues of this journal (edited by G. W. White) present a cross section of the knowledge of geology and the attitude toward it, by a considerable body of men in the Philadelphia area in 1831-32 and provide an interesting contrast to attitudes in some other parts of the country. The subtitle of the journal, "exhibiting the present state and progress of knowledge in zoology, botany, mineralogy, comparative anatomy, chemistry, meteorology, physical natural agents, and the antiquities and languages of the Indians of this continent," indicates the scope of the publication. Papers on fossils and fossil localities contain the original descriptions for several forms, but these original descriptions have been almost inaccessible. This volume includes notes, a bibliography, and a biographical sketch of Featherstonhaugh. — MCM

Fellows, L. D. *See* Thompson, Thomas L. 01361

08810 **Fenner, Peter.** (convener and editor). Models of geologic processes, an introduction to mathematical geology — AGI/CEGS short course lecture notes, Philadelphia, 1969: Washington, D. C., Am. Geol. Inst., sections paged separately, illus., tables, 1969.

This set of short course lecture notes is intended to aid understanding of the lectures, but is also expected to be valuable to students and teachers of geology who are concerned with quantitative aspects of their work. The lectures by W. C. Krumbein, M. E. Kauffman, R. B. McCammon, D. B. McIntyre, and H. N. Pollack are cited separately. — MCM

Ferguson, Charles W. *See* Mehringer, Peter J., Jr. 08608

Ferguson, Hershal C., Jr. *See* Levert, Charles F., Jr. 08437

08825 **Ferguson, Walter Keene.** Geology and politics in frontier Texas, 1845-1909: Austin, Tex., and London, Univ. Texas Press, 233 p., illus., 1969.

This case study of 19th century political and economic attitudes is atypical because Texas had complex governmental and economic problems, unusual history, widely divergent climate, and contended with the myth that the state had surface mineral deposits of vast potential. Geologists had to consider problems encountered nowhere else in North America and over an area one-twelfth that of the United States. The narrative provides an opportunity to assess various approaches to problems of evaluating natural resources of an underdeveloped area, which Texas was at that time. Chapter titles are: scientific and political preludes to state geological surveys; Shumard survey; gilded age; reconnaissance geologists discover individualities of Texas geology; Dumble survey; Phillips survey; stratigraphers interpret individualities of Texas geology; and the Bureau of Economic Geology. A 29-page bibliography, an index, and appendices are included. — MCM

08554 **Finlayson, C. Pratt; Maher, Stuart W.** Mineral resources summary of the Baileyton quadrangle, Tennessee: Nashville, Tenn., Tennessee Div. Geology, 4 p., 1969.

This text that accompanies Tennessee Div. Geology Geol. Map GM 180-SE by D. W. Byerly (cited separately) describes the limestone which is the only mined resource in the Baileyton quadrangle. The Mascot and Honaker Dolomites and the Jonesboro, Conococheague, and Maynardsville Limestones are all possible sources of general-purpose and agricultural dolomite or limestone; only the Jonesboro and Conococheague have been quarried and only on a very small scale. Barite has been prospected and shale and sand are potential resources. — MCM

01310 **Finnell, Tommy L.** Formations of the Bisbee Group, Empire Mountains quadrangle, Pima County, Arizona, *in* Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1968: U.S. Geol. Survey Bull. 1294-A, p. A28-A35, illus., 1970.

01311 **Finnell, Tommy L.** Pantano Formation, *in* Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1968: U.S. Geol. Survey Bull. 1294-A, p. A35-A36, 1970.

Fischer, A. G. *See* Ewing, M. 08532

Fischer, A. G. *See* Beall, A. O., Jr. 08545

08742 **Fischer, R. P.** Vanadium, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 185-186, table, 1969.

Roscoelite, the vanadium-bearing mica, is a minor gangue mineral in some gold-quartz veins in Baker County, and a "black sand" deposit in Curry County is reported to contain small amounts of vanadium. None of the known vanadium occurrences is judged to be of significant commercial potential. — MHM

08673 **Fisher, D. H.** Design for Baltimore Harbour Outer Tunnel: Tunnels and Tunneling, v. 1, no. 4, p. 187-189, illus., 1969.

A second tunnel crossing of Baltimore Harbour in Maryland, U.S.A., is now in the detailed design stage. This article reports on the site investigations already completed and describes briefly the open trench tunnel design. — Author's abstract

08595 **Fisher, D. Jerome.** Poikilitic albites in the microcline of granitic pegmatites [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 38, 1969.

01072 **Fisher, James H.** The Upper Cambrian strata of Michigan [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 388, 1970.

01177 **Fisher, Richard V.; Waters, Aaron C.** Base surge bed forms in maar volcanoes: Am. Jour. Sci., v. 268, no. 2, p. 157-180, illus., table, 1970.

Base surge density flows produced by shallow, explosive steam eruptions [maar volcanoes] are turbulent mixtures of steam and solid ejecta. Directional data indicate that the depositing currents originate within the craters and sweep outward at high velocities. They deposit dune-like bed forms of sand- to lapilli-size ejecta and may even plaster finer-grained and more cohesive debris against steeply inclined to vertical surfaces. These and other bed forms are developed from the interaction and interchange of bed materials and the base surge current passing overhead and must be governed by a set of variables in many ways similar to bed forms produced by debris-laden water in alluvial channels, wind-driven sand, and subaqueous turbidity currents. — *from* Authors' abstract

08518 **Fisher, W. L.** Facies characterization of Gulf Coast basin delta systems, with some Holocene analogues, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 239-261, illus., 1969.

Two basic types of delta systems contributed significantly to accumulation of the thick, Mesozoic-Cenozoic, terrigenous fill of the Gulf Coast Basin. High-constructive and high-destructive systems are distinguished on gross facies composition. The

former consist largely of fluvial and fluvially influenced facies, the latter of marine facies. Variants of the two types are recognized on basis of specific facies composition, facies geometry, vertical sequence and pattern, lateral facies distribution, facies association, and net sand pattern. Examples of high-constructive delta systems occur in the Lower Wilcox of Texas, Louisiana, and western Mississippi, Yegua and Jackson of Texas, Woodbine of Texas, and Cotton Valley of Mississippi and Louisiana; a Holocene analog of these systems is the Mississippi Delta system. High-destructive delta systems, exclusively of wave-dominated variety, characterize the Upper Wilcox, Vicksburg, and Frio of Texas; Holocene analogs include the Rhone, Po, Apalachicola, and Tabasco delta systems. — *from* Author's abstract

08806 **Fisher, W. L.** The nonmetallic industrial minerals — Examples of diversity and quantity: Mining Cong. Jour., v. 55, no. 2, p. 120-126, illus., 1969.

The nonmetallic minerals are divided into six groups: construction materials; bulk ceramic raw materials; specialty building materials and principal refractories; industrial, chemical and fertilizer raw materials; industrial rocks and minerals; and specialty grade and precious rocks and minerals. Group III materials are mined largely from open pits. Group IV occur irregularly and in restricted geologic terrains, large deposits are common to rare. Group V materials also occur irregularly, being formed under a variety of geologic conditions. Deposits of commercial grade and size are rare to common. Group VI mineral deposits are very restricted, small, and from only a few places in the world. — ESL

Fisher, William L. *See* Flawn, Peter T. 01383

01383 **Flawn, Peter T.; Fisher, William L.; Brown, L. Frank, Jr.** Environmental geology and the coast — Rationale for land-use planning: Jour. Geol. Education, v. 18, no. 2, p. 85-86, table, 1970.

This paper defines environmental geology as the application of geology to problems arising out of the interaction of people and the earth and uses the Texas coast as an example of an area where increasing population and industrialization are creating problems to which geology can be applied. The Bureau of Economic Geology of the University of Texas at Austin is compiling as a basic document for planning purposes, an Environmental Geologic Atlas of the Texas gulf coast. Its roughly 100 units are landforms and depositional units, depicting present processes, as well as units with engineering, navigation, pollution and reclamation significance, and for certain resources. Map units are listed in a table. — EH

01224 **Folayan, Joseph Ibikunle.** Reliability of predicted soil settlement [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3631B-3632B, 1970.

01256 **Follett, C. R.** Ground-water resources of Bastrop County, Texas: Texas Water Devel. Board Rept. 109, 138 p., illus., tables, 1970.

Principal aquifers in Bastrop County are, in order of increasing yields, the Wilcox Group, and Carrizo, Queen City, and Sparta Sands. The Reklaw, Cook Mtn., and Yegua Formations and alluvium along the Colorado River are less prolific. The Carrizo and underlying Wilcox are connected hydrologically and function as a single aquifer. Use of ground water is gradually increasing, but total of 3.7 mgd is small compared to quantity available. About 100 million acre-feet of fresh to slightly saline water is in transient storage, but only a fraction is economically recoverable by known methods at present costs. Yields of wells range from a few to about 1,800 gpm; yields of at least 2,000 gpm are possible from properly constructed and screened wells in the Carrizo-Wilcox aquifer. Dissolved-solids content of selected samples ranged from 67-4,020 mg/*l*; excessive iron is one of the chief problems, and the water is mostly moderately to very hard. — *from* Author's abstract

Footen, Joseph J. *See* Eitel, Dean F. 01135

01306 **Foster, Helen L.; Clark, Sandra H. B.** Geochemical and geologic reconnaissance of a part of the Fortymile area, Alaska: U.S. Geol. Survey Bull. 1312-M, p. M1-M29, illus., tables, 1970.

Analyses of stream-sediment and rock samples from the Fortymile area indicate several localities have weak geochemical anomalies; in most places, anomaly source is not known. Chromium and nickel in amounts above normal background in stream sediments probably came from ultramafic intrusions and greenstone. Some weak anomalies may be due to scattered sulfide minerals in low-grade metamorphic rocks and are not indicative necessarily of mineral deposits. The weak anomaly in the Champion Creek area is promising because galena has also been found in float. In the Alder Creek area silver was detected in two-thirds of the stream-sediment samples. In Gold Run, Joseph, and Hutchinson Creek areas there is evidence of mineralization associated with probable Tertiary igneous activity. Further sampling and geological exploration is warranted on the bases of abundance of small igneous intrusions, favorable host rocks, occurrence of placer gold, and presence of some bedrock prospects. — *from* Authors' abstract

Fowler, G. A. *See* Griggs, G. B. 01349

01215 **Fraunfelter, G. H.; Utgaard, John.** Middle Pennsylvanian edrioasteroid from southern Illinois: Jour. Paleontology, v. 44, no. 2, p. 297-303, illus., 1970.

A new species of edrioasteroid, *Agelacrinites hybolopus*, from the Conant Limestone Member of the Jamestown Cyclothem in southern Illinois represents the first undoubted Pennsylvanian record of the Edrioasteroidea. The more than 230 specimens examined represent a nearly complete ontogenetic series and exhibit changes in several external features during growth. Most of the edrioasteroids were encrusted on dead transported valves of brachiopods and pelecypods, which apparently lived on a moderately soft bottom. — Authors' abstract

08482 **Frazier, David E.** Depositional episodes — Their relationship to Quaternary sea-level fluctuations in the Gulf Coast region [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 611-612, illus., 1969.

08761 **Fredriksson, K.** The origin of chondrites (Deutsche zusammenfassung): Tschermaks Mineralog. u. Petrog. Mitt., 3d ser., v. 13, nos. 3-4, p. 353-355, table, 1969.

The principal elements in Ivuna, Murray, Allegan, Leedy, Karatu, and Pillistfer chondrites are compared. It is concluded that enstatite chondrites can be formed as condensate through impact in a gas cloud. This explains the reduced condition of these meteorites as well as the magnesium-silicon differentiation, the content of noble gases, and heavy volatiles, whose concentrations generally lie between those of the carbonaceous and ordinary chondrites, in spite of the fact that enstatite chondrites have obviously formed at high temperatures. — ESL

Freeman, John F. *See* Jackman, Sydney W. 08824

08454 **Frey, M. G.; Grimes, W. H.** Bay Marchand-Timbalier Bay-Caillou Island salt complex, Louisiana [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 266, 1969.

01279 **Frey, R. W.** The lebensspuren of some common marine invertebrates near Beaufort, North Carolina — [Pt.] 2, Anemone burrows: Jour. Paleontology, v. 44, no. 2, p. 308-311, illus., 1970.

Recent burrowing anemones near Beaufort, N. C., may be divided into two groups. Actinians — represented by *Paranthus rapiformis* (Lesueur) — dig vertical, unlined, body-size burrows which collapse readily if the animal is removed. Cerianthids — represented by *Cerianthopsis americanus* (Verrill) — construct durable, cnidaceous tubes which line their deep, vertical burrows. Except for bioturbate textures, actinian burrows are much less suited for preservation than cerianthid tubes. Tubes of conspecific cerianthids exhibit conspicuous morphologic variation; in the rock record this might be taken erroneously as a reflection of species diversity. Anemone burrows are potentially useful in environmental reconstructions, especially regarding deposition rates and substrate character; they may also be useful in paleobathymetry. — *from* Author's abstract

Friedman, Irving. *See* Manheim, F. T. 08542

08710 **Fritts, Crawford E.** Bedrock geologic map of the Marenisco-Watersmeet area, Gogebic and Ontonagon Counties, Michigan: U.S. Geol. Survey Misc. Geol. Inv. Map I-576, scale 1:48,000, sections, separate text, 1969.

Principal geologic structures of the Marenisco-Watersmeet area, in addition to the Marshall Creek and Barb Lake faults, are: a large NE-plunging anticline west of Lake Gogebic; a thick, NE-trending, SE-dipping monocline in the central section; and large domes near Watersmeet. Precambrian formations consist of pre-Animikie gneiss and granite, Animikie Series, Keweenawan Series, and Jacobsville Sandstone (Precambrian or Cambrian). Most of the area, glaciated in Pleistocene time, is blanketed by sand and gravel. — MCM

Frost, Stanley. *See* Peters, Walter G. 01096

Fuchs, Louis H. *See* Bunch, T. E. 08485

08496 **Fuchs, Louis H.** Occurrence of cordierite and aluminous orthoenstatite in the Allende meteorite: Am. Mineralogist, v. 54, nos. 11-12, p. 1645-1653, illus., 1969.

The first meteoritic occurrence of cordierite, in a nodule in the Allende Type III carbonaceous chondrite, is reported. X-ray powder patterns indicate that its structure is very close to that of hexagonal, or high cordierite. Associated minerals are aluminous orthoenstatite, anorthite, spinel, olivine, and sodalite. A discussion of the mineral assemblage is presented, but it cannot be established whether the inclusion formed as a highly fractionated system within the meteorite or as part of a chemical-pressure environment foreign to that indicated for the meteorite. — Author's abstract

Fuller, J. G. *See* Shearman, D. J. 08763

Furnish, W. M. *See* Nassichuk, W. W. 01220

08791 **Gable, Dolores J.** Geologic map of the Nederland quadrangle, Boulder and Gilpin Counties, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-833, scale 1:24,000, sections, text, 1969.

Bedrock of the Nederland quadrangle is completely folded metasedimentary gneiss perforated by igneous masses; the gneiss fold pattern was developed during two stages of plastic folding accompanying high-grade regional metamorphism of a dominantly sedimentary sequence characterized by lenticular and intergrading lithologic units which are repeated in many stratigraphic positions. The Boulder Creek Granodiorite, quartz monzonite and other related rocks were emplaced late in the folding period and are satellite to the Boulder Creek batholith, a few miles to the east. In the east-central part gneissic units indicate a major angular unconformity must be present within the sedimentary sequence. Tertiary stocks, dikes, and irregular masses cut the Precambrian rocks; related veins have been major sources of tungsten, silver, lead, gold, and minor sources of uranium and zinc. — MCM

08627 **García Tijerina, N.; Ramón Geic, A.** Las fracturas y su relación con la acumulación de hidrocarburos en la Cuemca de Chicontepec [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 83-84, 1969.

08559 **Garman, R. Keith.** Geologic map of the Welchland quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 328-NE, scale 1:24,000, separate text, 1969.

Mineral resources mined in the Welchland quadrangle are coal from the Bon Air seams and limestone in the Bangor Limestone. Thickness data are insufficient to estimate reserves of coal, but reserves of limestone are available in the St. Louis, Monteagle, and Bangor Limestones. Potential resources are sand, dimension sandstone, and shale. — MCM

08802 **Garman, R. Keith.** Geologic map of the Vale quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 9-SE, scale 1:24,000, separate text, 1969.

Mineral resources mined in the Vale quadrangle are sand for foundry and other purposes in the Clayton and McNairy Formations, and minor amounts of clay. A potential resource is heavy-mineral sand. — MCM

08695 **Garrison, Robert E.; Luternauer, John L.; Grill, Edwin V.; MacDonald, Robert D.; Murray, James W.** Early diagenetic cementation of Recent sands, Fraser River delta, British Columbia, *in* Lithification of carbonate sediments, [Pt.] 1: Sedimentology, v. 12, nos. 1-2, p. 27-46, illus., table, 1969.

Modern terrigenous sediments cemented by low-magnesian calcite are found in distributary channels and adjacent shallow-water marine localities at the front of the Fraser River delta. These permanently submerged areas are usually covered by sea water, including sea water intruded upstream along bottoms of river channels. The cemented sediments occur as irregular to platy nodular masses at or near to sediment-water interface, where they are frequently encountered during dredging. The cement consists of small crystals arranged in fibrous rims and other aggregates around and between sand grains. Processes leading to cementation are not yet known, but may include dissolution of calcareous shells by pore waters in buried sediments, followed by precipitation of calcite at higher levels from these fluids as they are expelled upward during compaction. — Authors' summary

Gartner, S. *See* Peterson, M. N. A. 01371

Gartner, Stefan. *See* Cita, Maria B. 01359

01232 **Geddes, Richard W.** Geochemical prospecting for mercury in the Terlingua, Texas mining district [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3706B-3707B, 1970.

01233 **Gevirtz, Joel L.** Paraecology of benthonic Foraminifera and associated microorganisms of the continental shelf off Long Island, New York [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3707B, 1970.

01321 **Giardini, A. A.** Emission spectrographic analyses of ruby-bearing margarite-anthophyllite-chlorite nodules and smaragdite from Habersham County, Georgia [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s20-s21, 1970.

Gibbs, G. V. *See* Brown, G. E. 08486

01285 **Gibson, Everett K., Jr.** Discovery of another meteorite specimen from the 1912 Holbrook, Arizona fall site: Meteoritics, v. 5, no. 1, p. 57-60, illus., 1970.

A recovered 1.5 kilogram specimen of the Holbrook chondrite is a heavily-weathered stone with fusion crust still intact; weathering has caused oxidation of almost all of the metallic iron. The Holbrook meteorite offers a unique situation in that material is available from the original 1912 fall, material collected by Nininger in 1931, and the 1968 material reported here. This ordinary chondrite is the only meteorite specimen (so far as the author is aware) in which effects of weathering, leaching, and enrichment of trace elements can be studied over periods of time before recovery. — MCM

01169 **Gilkerman, Elliot.** Roselle lineament of southeast Missouri: Geol. Soc. America Bull., v. 81, no. 3, p. 975-982, illus., 1970.

Examination of side-looking radar imagery of the St. Francois Mountains has revealed many structural features which are obscure or only poorly depicted on conventional aerial photographs. Most prominent is a distinct linear element herein named the Roselle fault. The structure traverses Precambrian and Paleozoic rocks. Analysis of geologic and topographic maps north and south of the area covered by radar imagery reveals a series of topographic and structural features remarkably well aligned with the Roselle fault. This alignment of features is termed the Roselle lineament and extends for over 155 miles from southwest of Poplar Bluff, Mo., NNE to the junction of the Mississippi and Missouri Rivers. It may have been important in localization of mineral deposition in southeastern Missouri. — HCW

08524 **Gilreath, J. A.; Healy, J. S.; Yelverton, J. N.** Depositional environments defined by dipmeter interpretation, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 101-111, illus., 1969.

A new method of dipmeter interpretation gives an estimation of water depth during deposition; the method is applied to high resolution dipmeter surveys in which short-interval correlations are machine-computed at closely spaced levels of the well. The major premise is that these short-interval dip computations reflect the energy of the depositional environment. High energy marine environments lead to a large scatter of dip magnitudes; conversely, low energy environments (deep water) lead to 'layer-cake' deposition and appear as uniform dip magnitudes on the plot. Thus, scatter of dip magnitude in a formation is the key by which depositional water depth is interpreted to be shallow, medium, or deep. Comparisons with paleoecologic data indicate the method to be valid and useful. Exceptions occur when original bedding is distorted. Despite these, dipmeter interpretation and paleoecologic data augment one another in defining depositional environments. — *from* Authors' abstract

08477 **Gimbrede, Louis de A.** *Aturia alabamensis* (Morton) in Jackson beds at Creola Bluff, Montgomery, Louisiana [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 507, 1969.

01126 **Giraud, A.** Application of pyrolysis and gas chromatography to geochemical characterization of kerogen in sedimentary rock: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 3, p. 439-455, illus., tables, 1970.

Pyrolysis and gas chromatography are combined in a new technique which characterizes the kerogen in a sedimentary rock. This technique makes it possible to determine with very small quantities (50-100 mg) of rock material, such as drill cuttings, the origin of the organic matter and its degree of evolution. — *from* Author's abstract

Glenn, E. E. *See* Zemanek, Joe. 01257

01235 **Godchaux, Martha Miller.** Petrology of the Greyback igneous complex and contact aureole, Klamath Mountains, southwestern Oregon [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3707B, 1970.

08758 **Godwin, L. H.; Peterson, N. V.** Geothermal energy, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 299-321, illus., table, 1969.

Areas of potential geothermal energy in Oregon are shown on a small-scale map. The three that appear to be most favorable for commercial utilization are Klamath Falls in Klamath County, and Lakeview and Crump Valley, in Lake County. Deeper drilling and detailed exploratory work are needed to determine the geothermal potential of these areas. — MHM

01073 **Goebel, Edwin D.; Chronic, John.** New ages based on conodonts for some pre-Pennsylvanian rocks in southern Front Range, Colorado [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 388-389, 1970.

Goldstein, Robert F. *See* Andress, Noel E. 08463

08525 **Goldstein, Robert F.; Cramer, Fritz H.; Andress, Noel E.** Silurian chitinozoans from Florida well samples, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 377-384, illus., 1969.

Chitinozoans of Silurian age were recovered from four wells in Florida: Cone No. 1, Tillis No. 1, Hilliard No. 1, and Kie Vining No. 1. An attempt was made to establish a correlation between these four wells using the chitinozoan evidence. The correlation is presented in text-figure 2. The youngest assemblage encountered is probably Ludlovian in age; the oldest is of late Llandoverian age. — Authors' abstract

Goll, R. *See* Peterson, M. N. A. 01371

08497 **Gomes, Celso de Barros.** Electron microprobe analysis of zoned melanites: Am. Mineralogist, v. 54, nos. 11-12, p. 1654-1661, illus., table, 1969.

Microprobe traverses were made across four zoned melanites showing very dark brown cores surrounded by narrow lighter bands. This garnet is from two Brazilian nepheline syenites. The central parts of the crystals are richer in TiO_2 and poorer in SiO_2 and FeO_3 than are the margins. A plot of Ti (total) against Si and Fe atoms in the unit cells suggests that the addition of Ti is accompanied by the loss of approximately equal amounts of Fe and Si. — *from* Author's abstract

08629 **Gómez Ponce, M.** Estudio bioestratigráfico de los sedimentos terciarios que suprayacen una proción de la Faja de Oro Marina de la Plataforma Continental del Golfo de México [abs.]: Inst. Mexicana Petróleo Rev., v. 1, no. 3, p. 84, 1969.

08635 **González Alvarado, J.** Interpretación estructural del área Encrucijada-Chontalpa, basada en estudios de sismología y geología de subsuelo [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 87, 1969.

08625 **González, R.** Áreas con posibilidades de producción en sedimentos del Jurásico Superior (Caloviano-Titoniano) [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 83, 1969.

Goodall, Vanne Morris. *See* Leakey, L. S. B. 08709

Goodell, H. G. *See* Hopkins, E. M. 08468

Gorbunova, Z. N. *See* Rateev, M. A. 08692

Gordon, George E. *See* Gotautas, Vito A. 08455

08455 **Gotautas, Vito A.; Gordon, George E.; Johnson, Johnnie F.; Lee, Clyde.** Southwest Lake Arthur Field, Cameron Parish, Louisiana [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 267, 1969.

01207 **Gould, Stephen Jay.** Coincidence of climatic and faunal fluctuations in Pleistocene Bermuda: Science, v. 168, no. 3931, p. 572-573, illus., 1970.

As the climate of Pleistocene Bermuda oscillated during the last two glacial cycles, coincident variation occurred for a variety of independent events in the form and diversity of land snails. This variation was influenced primarily by the availability of calcium carbonate for shell construction. — Author's abstract

Grant, F. S. *See* Spector, A. 01259

01218 **Greeley, Ronald.** Life-orientation relationships of some Eocene bryozoan-coral associations: Jour. Paleontology, v. 44, no. 2, p. 343-345, illus., 1970.

Specimens of *Oligotresium* sp., *Lunulites jacksonensis* (Canu and Bassler, 1920) and of *L. bouei* Lea, 1833, occur in Eocene deposits of the Gulf Coastal Plain [Alabama and Mississippi] with small unidentified corallites attached to the frontal surface of the lunulitiform zoaria. Position and relationship of the corallites on the bryozoans indicate orientation of fossil zoaria was apex-up, and that natatory activities by the zoaria were unlikely. The association apparently was not harmful to bryozoan colony or coral; the only effect was flatter zoarial growth than normal. — Author's abstract

Greene, John F. *See* Smith, Charles I. 01104

01322 **Gregor, Bryan.** The human factor in denudation [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s21, 1970.

08653 **Gregory, Irene.** Worm-bored poplar from the Eocene of Oregon: Ore Bin, v. 31, no. 9, p. 184-185, illus., 1969.

Crescent-shaped chips of wood appear to be floating in the clear chalcedony filling a worm tube formed in a poplar tree during the Eocene. The specimen was collected from a Clarno Formation outcrop in Crook County. Typical anatomical features of the poplar wood preserved in this specimen include growth rings, small vessels in short radial rows, rays, and parenchyma. The specimen resembles Asiatic *Populus* of today more than North American members. — ESL

08688 **Gregory, Irene.** Fossilized palm wood in Oregon: Ore Bin, v. 31, no. 5, p. 93-110, illus., 1969.

The occurrence of palm wood in the fossil record serves as an indicator of past climates and age of the rocks. Palms are considered to be the first angiosperms to appear in the fossil record; types of stems found as fossils are described. This report is concerned primarily with wood, but leaves and fruits are also reviewed. The geologic history of palms and their occurrence as fossils in Oregon is summarized. A sketch map shows fossil palm localities, and some suggestions are given for collectors. — ESL

Gresens, Randall L. *See* Campbell, K. Vincent. 01190

Griffin, G. M. *See* Manker, J. P. 08474

08526 **Griffin, G. M.; Tedrick, P. A.; Reel, D. A.; Manker, J. P.** Geothermal gradients in Florida and southern Georgia, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 189-193, illus., 1969.

Bottom hole temperatures from electric log surveys were collected from all nonconfidential oil tests that recorded temperature data. These data include points from 287 wells in Florida and 33 in Georgia. Computed gradients were compiled into county averages, and a preliminary geothermal gradient map was drawn. Peninsular Florida, south of a NE-SW trending zone through Taylor and Nassau Counties, is characterized by gradients generally less than 1.0°F/100 feet. Northern Florida and southern Georgia are characterized by gradients that generally exceed 1.0°F/100 feet. A weak and questionable increase in gradient may occur over the Sunniland Field in southwest Florida. The observed NE-SW geothermal trend parallels the Appalachian Mountain belt and coincides with known magnetic and gravity features of the area. It also parallels the migrating Cretaceous to Recent clastic-nonclastic boundary in northern Florida. — Authors' abstract

Griffin, James B. *See* Crane, H. R. 01381

08797 **Griggs, A. B.** Geology of the Cascade Range, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 53-59, illus., 1969.

The Cascade Range is part of a mountain chain that borders the Pacific slope of North and South America. In Oregon, the Range separates into two north-south belts: the Western Cascades are made up mainly of slightly deformed and altered volcanics of late Eocene to late Miocene age; the High Cascades are a narrow plateau of basalt and basaltic andesite lavas built up in Pliocene and later time. Here glaciation carved the summits of younger volcanic peaks into their present shape, and alpine glaciers remain in some places. Mercury and gold, silver, copper, lead, and zinc have been produced. — MHM

Griggs, G. B. *See* Duncan, John R. 01122

01349 **Griggs, G. B.; Kulm, L. D.; Duncan, J. R.; Fowler, G. A.** Holocene faunal stratigraphy and paleoclimatic implications of deep-sea sediments in Cascadia Basin: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 7, no. 1, p. 5-12, illus., table, 1970.

Hemipelagic sediments in Cascadia Basin were characterized by an abundance of planktonic foraminifers during glacial periods and by an abundance of radiolarians

during interglacial periods. The relative abundances of these organisms are used to construct a paleoclimatic curve which includes several intervals indicative of cooling periods within the Holocene. These periods, from 5,000 to 4,000 and at 2,000 years B.P. appear to correlate with those reported in other paleoclimatic studies in widely separated localities. — Authors' summary

Grill, Edwin V. *See* Garrison, Robert E. 08695

Grimes, W. H. *See* Frey, M. G. 08454

01375 **Grissinger, E. H.; McDowell, L. L.** Sediment in relation to water quality: Water Resources Bull., v. 6, no. 1, p. 7-14, 1970.

Individual relationships between sediment and the physical, chemical and biological characteristics of water determine water quality and its suitability for an intended purpose. Physical properties of coarse-grained sediments and both physical and chemical properties of fine-grained sediments are significant. Sediment, as the prime polluter of water, is the major factor in evaluating its suitability and also affects the suitability through its physical influence on biological activity. Fine-grained sediments, that is, clay minerals and amorphous and organic materials, have chemically active surfaces and may take ions from or release them to solutions. The paper defines problems concerning the role of sediment in the ternary system, the sediment-water-dissolved chemical load, which is not yet well enough understood to define its influence on the biological characteristics of water or its suitability for long-term uses. — *from* Authors' abstract

Grob, E. A. *See* Peterson, N. V. 08687

Gross, David L. *See* Collinson, Charles. 01064

08769 **Gudmandsen, P.** Airborne radio echo sounding of the Greenland ice sheet, [Pt.] 2 *in* Glacier sounding in the polar regions, a symposium: Geog. Jour., v. 135, pt. 4, p. 548-551, illus., 1969.

In a series of test-flights, described here, a 35 MHz transmitter, with a sending and a receiving aerial was flown low across the ice. The maximum ice thickness detected in this experiment was 2,200 m; continuous records of bedrock echos could be obtained only for thicknesses less than 1,800 m. The limitations are a result of an apparent reduction of receiver sensitivity due to short-wave radio interference and a large absorption of radio waves by the ice. The absorption is shown on a contour map of the island; the gradient is large in the border zone of the inland ice. In order to overcome the absorption in the central part of the inland ice, a larger system is being designed. — HRC

Guerrera, A. A. *See* Perlmutter, N. M. 01263

08494 **Gupta, G. C.; Malik, W. U.** Fixation of hydroxy-aluminum by montmorillonite: Am. Mineralogist, v. 54, nos. 11-12, p. 1625-1634, illus., 1969.

An aluminum hydroxide-montmorillonite complex prepared at an OH/Al ratio of 3.0 (16 meq Al/g clay) and immediately cleaned of any free hydroxy-aluminum behaves like aluminum-chlorite and shows no change after six months ageing. Hydroxy-aluminum completely precipitates within the interlayer space of montmorillonite. Electrophoresis studies show that the hydroxy-aluminum precipitated in montmorillonite is present as uncharged aluminum hydroxide. X-ray diffraction analysis, thermal (DTA and TGA) studies, infrared absorption analysis, polarographic reduction behaviour, and cation exchange capacity measurements confirm the complete (and stable) transformation of montmorillonite to chlorite structure. — *from* Authors' abstract

08633 **Gutiérrez Gil, R.** Aspectos geológicos generales de la zona sur [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 86-87, 1969.

01368 **Guyton, William F., and Associates.** Ground-water conditions in Angelina and Nacogdoches Counties, Texas: Texas Water Devel. Board Rept. 110, 125 p., illus., tables, 1970.

Geologic formations which constitute the principal aquifers in Angelina and Nacogdoches Counties are: Carrizo Sand (most productive, total pumpage estimated at 26.7 mgd, yields up to 1,500 gpm, estimated total supply available for additional development 32 mgd); Wilcox Group (pumpage 0.5 mgd in 1968, estimated potential yield 8 mgd, estimated maximum yield 500 gpm, water more mineralized than in the Carrizo); Yegua Formation (quality variable and unpredictable, estimated pumpage in 1968 2.8 mgd, estimated potential yield 7 mgd, estimated maximum yield 500 gpm); Sparta Sand (estimated pumpage in 1968 0.1 mgd, estimated potential yield 7 mgd, estimated maximum yield 500 gpm). No evidence has been found of any serious contamination of ground water from oil-field brines; there is possibility of future encroachment in the Carrizo and Yegua Formations. — *from* Authors' abstract

Hade, George. *See* Molnar, Peter. 01298

08505 **Halverson, Mark O.** Some applications of time-sharing in mining geophysics, *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 23-31, illus., 1969.

Some applications of remote terminal computer time-sharing to mining geophysics are discussed. Evaluations are based largely upon one and one-half years experience with the General Electric Mark I and Mark II systems. A terminal consisting of a teletypewriter and a paper tape system is placed at the user's location, input is on paper tape or keyboard, and output is printed on paper and may also be placed on paper tape. Available languages consist of BASIC, FORTRAN and ALGOL. The time-sharing system is considered very useful in large part because the terminal is available for use as the need arises. Usage is varied: geophysical field data can be put on paper tape and be computer reduced; time-sharing is excellent for statistical studies; the system is adequate to generate geophysical parameter values derived from simple models of the subsurface and to make comparisons with field data. — *from* Author's abstract

Harbison, R. N. *See* Weeks, L. A. 08530

08700 **Harland, Brian.** (chairman). Glacier sounding in the polar regions, a symposium: Geog. Jour., v. 135, pt. 4, p. 547-563, illus., 1969.

This symposium was held by the Royal Geographical Society on February 17, 1969. Five papers, each cited separately by author, and discussions are included. The emphasis is upon examples of the use of radio-echo sounding as a tool in subglacial topography determinations. Examples are cited from Greenland, Ellesmere Island, and the Antarctic. Included in the discussion is a description of the useful application of radar-sounding techniques. — HRC

08809 **Harper, H. E.; Reynolds, J. R.** The Lakeshore copper deposit: Mining Cong. Jour., v. 55, no. 11, p. 26-30, illus., 1969.

A major porphyry-type copper deposit, discovered in Pinal County, Ariz., in 1968 contains 470 million tons of sulfides and oxides averaging 0.75 percent copper. Mineralization was recognized in the early 1880's, and several attempts were made to develop it. This new discovery lies at greater depth and west of the original orebody. Pinal Schist is the oldest exposed formation, overlain by the Late Precambrian Apache Series; five Paleozoic formations are described. Cretaceous andesitic volcanics are overlain by Tertiary fanglomerate, all intruded by a quartz-diorite stock. Porphyry intrudes metasediments and andesite. Host rocks for copper mineralization are andesite, porphyry, and metasediment-diabase sequence overlying the intrusive. Mineralization is younger than but associated with the porphyry. Mineralization present includes disseminated oxide and sulfide, and replacement or tactite ore. — ESL

08508 **Harris, D. P.** Quantitative methods, computers, reconnaissance geology and economics in the appraisal of mineral potential, *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 83-117, tables, 1969.

This paper examines recent developments and work in progress on the application of quantitative methods and computers to the appraisal of the mineral resource potential of discrete areas by employing reconnaissance geological information and general economic relationships. The perspective of this paper might be that of a firm planning a regional exploration program or of a legislative body seeking to choose between several alternative actions on the basis of their impact upon the regional resources. In addition to this general survey and commentary, an example is presented of the use of geostatistical analysis and computer simulation to evaluate the economic mineral resources of the Seward Peninsula of Alaska. — Author's abstract

Harrison, C. G. A. *See* Ball, M. M. 08528

01141 **Harrison, Samuel S.; Clayton, Lee.** Effects of ground-water seepage on fluvial processes: Geol. Soc. America Bull., v. 81, no. 4, p. 1217-1225, illus., 1970.

A small stream below Sherman Glacier, south-central Alaska, was losing water in the upper reach and gaining in the lower. In the losing reach the bed was hard and stable; in the gaining reach, the bed was "quick" in spots and unstable. Flume experiments with clean sand failed to duplicate field conditions, but when fines were introduced, a mud seal was formed among sand grains in the losing reach of the flume, increasing effective density. In the flumes, upward seepage reduced, and downward seepage steepened bed forms and bed roughness, but the changes caused no measurable change in slope of water surface. — JHF

Harward, M. E. *See* Norgren, J. A. 01200

08701 **Hattersley-Smith, G.** Results of radio echo sounding in northern Ellesmere Island, 1966, [Pt.] 4 *in* Glacier sounding in the polar regions, a symposium: Geog. Jour., v. 135, pt. 4, p. 553-557, illus., 1969.

The profiles of the Gilman, Disraeli, and other glaciers were determined by radiowave techniques. A very undulating bedrock topography is indicated below the apparently smooth surface of the ice. The Disraeli appears to be grounded below sea level before going afloat; the floating portion has a thickness up to 120 m, and is separated by fjord ice from another glacier lobe downfjord. The M'Lintock and Milne glaciers, entering fjords farther to the west, are shown to be grounded below sea level for distances of 30 and 45 km. Traverses over the Ward Hunt ice shelf distinguish the transition from land ice to ice shelf and from ice rise to ice shelf. The Ward Hunt and Marvin ice rises are all grounded below sea level. A subglacial ridge is detected below the Otto glacier; its relation to the ice surge of Otto between 1950 and 1959 is discussed. — HRC

08787 **Haubrich, Richard A.** Spectra of earthquake time series [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 409-410, illus., table, 1969.

Illustrations are shown of the typical reddening in the spectrum of most earthquake time series and of the almost white spectrum of deeper earthquakes. The spectrum of events below 200 km is indistinguishable from that of a Poisson process. The cross spectrum between earthquake occurrences in different regions was estimated for several pairs of time series. — KAF

08538 **Hay, W. W.** Preliminary dating by fossil calcareous nannoplankton, Deep Sea Drilling Project, Leg 1, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D.C., U.S. Govt. Printing Office, p. 388-391 [1969?].

Cretaceous-Pleistocene ages are interpreted from the 88 samples studied. Those from the Gulf of Mexico also indicate possible positions of the Mississippi delta. — ESL

Hay, William W. *See* Marszalek, Donald S. 08462

08646 **Hay, William W.** On defining boundaries between the Paleocene, Eocene, and Oligocene, *in* Colloque sur l'Éocène, Paris, 1968, V. 3: [France] Bur. Recherches Géol. et Minières Mém. 69, p. 197-200, 1969.

Hay and Mohler (1968) have suggested the use of combination calcareous nannoplankton and planktonic foraminiferal zones to increase biostratigraphic resolution; boundaries of zones based on first (or last) occurrences of species can be determined separately for the two groups provided the sections examined are sufficiently continuous and complete. Hay discusses the sections (all in the Old World) proposed in this colloquium for defining the limits of the Eocene, and concludes that none of the Paleocene-Eocene boundary sections is particularly favorable for use as an international standard. An ideal section should be marine, continuous, with abundant, preferably wide-ranging pelagic fossils both below and above the proposed boundary. The sections proposed either consist of nonmarine strata or rest on essentially nonmarine strata; serious thought should be given to defining the Paleocene-Eocene boundary in another section. — VMJ

08493 **Hayashi, Hisato; Otsuka, Ryohei; Imai, Naoya.** Infrared study on sepiolite and palygorskite on heating: Am. Mineralogist, v. 54, nos. 11-12, p. 1613-1624, illus., table, 1969.

In addition to X-ray and thermal analysis, infrared absorption spectra of sepiolite and palygorskite from the Kuzu District, Tochigi Prefecture, Central Japan, have been obtained in the hydroxyl stretching region. Absorption bands are assigned on the basis of behavior during dehydration and rehydration. — Author's abstract

08450 **Haye, Edward F.** Photogeologic applications in the Gulf Coast [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 264, 1969.

Haynes, C. Vance. *See* Hemmings, E. Thomas. 08606

Hays, J. D. *See* Riedel, W. R. 08541

Hays, W. H. *See* Robinson, G. D. 08677

Healy, J. S. *See* Gilreath, J. A. 08524

01379 **Heindl, L. A.** Proposal for a U.S. National Water Atlas: Water Resources Bull., v. 6, no. 1, p. 1-6, 1970.

The U.S. National Committee for the International Hydrological Decade is proposing a National Water Atlas as a contribution to the improvement of the quality of information available for large-scale planning and management studies. The atlas would provide hydrological maps of the United States and its territories at a scale of 1:5,000,000 and of the 17 principal basins, delineated by the Water Resources Council, at 1 to 2,500,000. Data would be presented with a common standard period of record, preferably 1941-70, as a base. Map subjects would include station networks, radiation, precipitation, snow and ice, evaporation, atmospheric vapor fluxes, surface-water discharge, ground-water storage and discharge, chemical quality, sediment discharge, water temperatures, and soil moisture, and additional maps as information is available and the need arises. — *from* Author's abstract

01074 **Heinrich, E. W.** The Goldie carbonatite, Fremont County, Colorado — A unique cryolite occurrence [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 389, 1970.

Heinrichs, D. F. *See* Couch, R. W. 08578

Helander, D. P. *See* Konen, C. E. 01271

01121 **Helwig, James.** Slump folds and early structures, northeastern Newfoundland Appalachians: Jour. Geology, v. 78, no. 2, p. 172-187, illus., 1970.

Submarine slumping is to be expected in rapidly deposited muddy eugeosynclinal sediments. Interbedded shale and graywacke (flysch) of Late Ordovician age in northeastern Newfoundland displays abundant mesoscopic slump folds, identified by their variable style and wavelength, curvilinear hinges, and localization between undisturbed strata. The slump folds are interpreted as contemporaneous with tectonic folds in underlying strata. Caution should be used in interpreting early folds in areas of superposed deformation because of possible confusion of slump folds with pre-metamorphic tectonic structures. — JCR

08606 **Hemmings, E. Thomas; Haynes, C. Vance.** The Escapule mammoth and associated projectile points, San Pedro Valley, Arizona: Arizona Acad. Sci. Jour., v. 5, no. 3, p. 184-188, illus., table, 1969.

Investigations of the site discovered by Escapule in 1966 on Horsethief Draw indicate that a large, immature Columbian mammoth, injured by Clovis points, eventually died about 11,200 years ago but showed no signs of butchery. The Pliocene-Pleistocene valley fill of fluvial and lacustrine sediments called Benson beds, reflecting several erosional-depositional cycles, ensured rapid burial and preservation of the carcass, altho parts may have been exposed during two episodes of erosion prior to modern arroyo-cutting. The head cut of the draw reached the site about 1900. No more than two points associated with ribs were found. Assignment to *Mammuthus (Parelephas) columbi* was based on occurrence and size of the few bones described, since grinding teeth were not available; their condition suggests an age of 15 or 25 years. — GDC

Henkel, Donald. *See* Sendlein, Lyle V. A. 01103

Henniger, B. R. *See* Martin, W. D. 01367

01157 **Herbert, Robin.** Modelling partially penetrating rivers on aquifer models: Ground Water, v. 8, no. 2, p. 29-36, illus., table, 1970.

A technique is presented for simulating partially penetrating rivers on two dimensional resistance-capacitance network analog aquifer models. The method is tested against an analytic solution due to Boulton (1942). Several results are presented which can be used to estimate an approximate value for the steady state discharge of a well pumping near to a partially penetrating river. — Author's abstract

Herlihy, Daniel E. *See* Fagg, Clint F. 08442

08764 **Heroy, William B.** (editor). Unconventional methods in exploration for petroleum and natural gas — A symposium under the auspices of the Institute for the Study of Earth and Man, Southern Methodist University [1968]: Dallas, Tex., Southern Methodist Univ., 241 p., illus., tables, 1969.

This symposium was an effort to provide a forum for discussion of refinement of existing techniques and development of those more unconventional to discover and develop new reserves of petroleum and natural gas as a basis for maintenance of present production and for future increases to meet population growth. Of the 16 papers presented, 12 are cited separately in Abstracts of North American Geology, September 1970. — MCM

08739 **Herz, Norman.** Titanium, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 172-175, illus., 1969.

Oregon has no titanium deposits that are economically exploitable at present. Ferruginous bauxite deposits containing ilmenite occur in a discontinous 100-mile belt in Columbia, Washington, Polk, Yamhill, and Marion Counties. Total resources of TiO_2

in these bauxites are estimated at about 3.25 million tons. Ilmenite is present in the black sands that occur in beaches and terraces of the Oregon coast, but the quantity of ilmenite in deposits checked is too low for commercial exploitation except for local concentrations in the Coos Bay area. — MHM

Hilemae, Karen. *See* Crompton, A. W. 01269

Hildreth, Robert A. *See* Barker, Fred. 08658

01166 **Hill, F. L.** Northwest San Joaquin gas field: California Oil Fields — Summ. Operations 1969, v. 55, no. 1, p. 39-43, illus., tables, 1970.

Northwest San Joaquin gas field in Fresno County is composed of Upper Cretaceous to Holocene formations. The structure is an anticlinal fold of low relief, trending NW to SE; subsurface studies indicate no major faulting. An important regional feature is the NW thinning of sediments deposited above the post-Oligocene unconformity. The northerly reversal of regional dip, which forms the structural trap and occurs in the Kreyenhagen and older sediments, is not reflected in the younger deposits. Gas is produced from lenticular Nortonville sands in the lower portion of the Eocene-Oligocene Kreyenhagen Formation. Total production from February 1968 to June 1969 was more than 789,000 MCf gas. — MCM

01205 **Hilpman, Paul L.** Devonian rocks in Kansas and their epeirogenic significance [abs.]: Kansas Geol. Survey Bull. 199, pt. 1, p. 75, 1970.

Hladik, William B. *See* Bauleke, Maynard P. 01203

08740 **Hobbs, S. W.; Magill, E. A.** Tungsten, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 175-180, illus., table, 1969.

Known occurrences of tungsten minerals are restricted to the Medford-Ashland area in Jackson County and the Wallowa-Blue Mountains area in Wallowa, Baker, Grant, and Union Counties. Most of the recorded production came from Jackson County. Most discoveries are restricted to sparse grains of scheelite, the only tungsten mineral identified in the State, and are marginal in nature. Prospects for potential tungsten production are quite limited; however, much of the terrane probably has not been adequately prospected. — MHM

08773 **Hofmann, Reuner B.** Earthquake prediction from fault movement monitoring in California [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 381, 1969.

Annual measurements of the distance between station marks on either side of the San Andreas fault have yielded estimates of fault movement. Earthquakes have been predicted from anomalies measured. — KAF

Holden, J. *See* Wilde, P. 01346

Holdridge, D. A. *See* Davis, C. E. 08702

Holmes, Robert F. *See* Eitel, Dean F. 01135

01386 **Holtedahl, Olaf.** On the morphology of the West Greenland shelf with general remarks on the "marginal channel" problem: Marine Geology, v. 8, no. 2, p. 155-172, illus., 1970.

Of the series of marginal channels outside the West Greenland coast, the Godthaab depression with its regularly curving trend and exceedingly steep eastern slope is of interest, as is the great depth of the channel in Melville Bay. Geophysical surveys over similar channels off the Labrador coast have shown them to be not the result of faulting but rather a gently inclined slope of old (basement) rock which has been covered by sedimentary deposits, probably Mesozoic or younger, with increasing thickness outward. The channels have been formed along the innermost zone of this

less resistant material, the typical deep and sharply cut ones (closely connected with transverse channels) predominantly by glacial erosion. — *from* Author's summary

01158 **Honduras Instituto Geográfico Nac.** Mapa geológico de Honduras — Nueva Armenia (Hoja 2757 II G): Tegucigalpa, Honduras, Ministerio de Comunicaciones y Obras Públicas, scale 1:50,000 [n.d.].

01159 **Honduras Instituto Geográfico Nac.** Mapa geológico de Honduras—Tegucigalpa (Hoja 2758 IIG): Tegucigalpa, Honduras, Ministerio de Comunicaciones y Obras Públicas, scale 1:50,000, text [n.d.].

The following formations are described briefly in the text: Triassic El Plan, Cretaceous Atima y Cantarranas, Cretaceous-Tertiary Valle de Angeles, Tertiary unnamed andesite and Jutiapa, Tertiary or Quaternary andesitic and basaltic lavas, and Quaternary alluvium. — MCM

01160 **Honduras Instituto Geográfico Nac.** Mapa geológico de Honduras — San Buenaventura (Hoja 2757 I G): Tegucigalpa, Honduras, Ministerio de Comunicaciones y Obras Públicas, scale 1:50,000 [n.d.].

08468 **Hopkins, E. M.; Goodell, H. G.; Chesser, S. A.; May, J. P.; Poché, D. J.** The relict nature of the sediments and submarine topography off Alligator Harbor, Florida, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 445-464, illus., table, 1969.

An offshore area south of Alligator Harbor, Florida contains several linear shoals separated by a number of relatively flat-floored 'valleys'. Eighty-six sediment samples were analyzed for texture by standard laboratory technique. The simplest model of sediment distribution is one of increasing grain size and decreasing sorting with increasing water depth. Correlation of this pattern and other lithologic attributes with a vertical stratigraphic section from an onshore boring suggests that the sampled area represents a subaerially eroded surface in which there has been only limited modification by marine processes during the most recent rise in sea level. Modification consists of movement of finer fraction onto shoals with minor return to some deeper channels. — *from* Authors' abstract

Hopson, James A. *See* Barghusen, Herbert R. 01206

01075 **Horowitz, Alan Stanley.** Biotic diversity in the Chesterian (Upper Mississippian) rocks of the Illinois basin [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 389-390, 1970.

01300 **Horsfield, W. T.; Maton, P. I.** Transform faulting along the De Geer line: Nature, v. 226, no. 5242, p. 256-257, illus., 1970.

Fault plane solutions for two of four earthquakes along the Spitsbergen Fracture Zone in 1966-68 confirm that this zone is an active transform fault with dextral strike slip motion, separating the spreading axis of the Arctic Ocean from that of the North Greenland Sea. With this and other data it is possible to determine the pole of rotation of Greenland and North America with respect to Europe according to the theory of plate tectonics. This pole is located at about 124°E (±5°), 66°N (±5°), and angular velocity of rotation around it, based on magnetic data from Reykjanes Ridge, is 3.7×10^{-7} deg per yr. — DBV

08737 **Hotz, P. E.; Ramp, Len.** Nickel, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 163-167, illus., 1969.

The only production of nickel ore in the United States is from Nickel Mountain, Douglas County, Oreg., where more than 9 million tons of ore were mined between 1954 and 1965. Except for the copper-nickel sulfides at the Shamrock mine in Jackson County, Oregon's known resources of nickel are principally of the lateritic type in the southwestern part of the State. Ore reserve estimates of the Nickel Moun-

tain deposit in 1963 placed the life expectancy of the deposit at 13-15 years. Ferruginous nickeliferous lateritic deposits in Josephine and Curry Counties may contain on the order of 30 million tons of ore that averages 0.8 percent or less nickel. — MHM

01234 **Howard, James Campbell.** Simulation of salt dome forms [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3707B-3708B, 1970.

08447 **Howard, James D.** Radiographic examination of variations in barrier island facies, Sapelo Island, Georgia, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 217-232, illus., 1969.

Abrupt lateral variations which characterize the facies of present day barrier islands are the result of differences in texture and in physical and biogenic sedimentary structures. Facies variations associated with sedimentary environments at Sapelo Island, Georgia, illustrate these differences. X-ray radiography is a valuable method for examining and illustrating facies characteristics because the technique accentuates subtle as well as obvious sedimentary structures and fabrics. — Author's abstract

08517 **Hoyt, John H.** Late Cenozoic structural movements, northern Florida, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 1-9, illus., 1969.

Six prominent coastlines defined in southeastern Georgia have been traced southward into northern Florida where lagoonal-salt marsh sediments of the Wicomico Formation are encountered at progressively higher altitudes. Maximum uplift is east of Starke along the northeast flank of Ocala Uplift where salt marsh sediments are at about 166 feet or 65 to 70 feet higher than in Georgia. Penholoway salt marsh sediments are at an altitude of 95 feet (70-75 feet in Georgia), Talbot salt marsh sediments (40-45 feet in Georgia) are displaced 5 to 10 feet in the area of maximum uplift in Florida, and Pamlico salt marsh sediments (24 feet in Georgia) are as high as 32 feet south of St. Augustine. Thus, there is progressively less warping of lower, younger coastlines. South of Ocala Uplift the five lower Pleistocene coastlines return to approximate Georgia altitudes. The oldest coastline, Pliocene or Pleistocene, maintains an altitude of 140-150 feet for more than 150 miles south of maximum uplift. *from* Author's abstract

Hueber, Francis M. *See* Churkin, Michael, Jr. 08672

Hughes, Thomas C. *See* Carpenter, Robert H. 01319

01323 **Hughes, Thomas C.; Carpenter, Robert H.** Magnetite-bearing quartzite in southwestern Jackson County, Georgia [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s21, 1970.

Hurley, Robert J. *See* Andrews, James E. 01138

Hutchinson, R. D. *See* Cotter, R. D. 08765

Huttrer, Gerald W. *See* Hyde, Jack H. 01130

01130 **Hyde, Jack H.; Huttrer, Gerald W.** Geology of central Grant Range, Nevada: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 3, p. 503-521, illus., table, geol. map, 1970.

The area mapped in the report consists of about 125 square miles in the central Grant Range in Nye County, Nevada. Paleozoic rocks in the area are dominantly carbonates and subordinate amounts of clastics and are about 26,000 feet thick. These rocks are as old as Cambrian in age and as young as Pennsylvanian. Regional metamorphism occurred in the area prior to major faulting. Metamorphism and thrust faulting are believed to be Mesozoic in age. — SEF

01076 **Ibrahim, Abdelwahid.** The application of the gravity method to mapping bedrock topography in Kalamazoo County, Michigan [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 390, 1970.

Imai, Naoya. *See* Hayashi, Hisato. 08493

08665 **Inman, Maurice C.** Electron microscope — Prime tool for materials science: Earth and Mineral Sci., v. 39, no. 1, p. 1-5, illus., 1969.

Highlights of the birth and development of modern electron microscopes, including some predictions of likely paths of progress into the 1970's, are presented. The tremendous contribution that the electron microscope has made in the hands of scientists to modern ideas of atomic structure is equally important. — ESL

Inman, Maurice C. *See* Bell, Maurice E. 08693

08616 **Instituto Mexicano del Petróleo.** Filtrado óptico con rayos laser: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 79, 1969.

The Instituto Mexicano del Petróleo has just acquired special laser equipment for optical processing of seismic data. It will be used for studying geologic photographs and for eliminating noise from seismic sections, as well as for filtering and for defining frequency spectrums of seismic events. The instrument produces a beam with a wave length of 6328 A. — EH

Isacks, Bryan L. *See* Sykes, Lynn R. 08780

Iselhardt, C. *See* Wilde, P. 01346

08824 **Jackman, Sydney W.; Freeman, John F.** (editors). American voyageur — The journal of David Bates Douglass [1790-1849]: Marquette, Mich., Northern Michigan Univ. Press, 128 p., illus., 1969.

01077 **Jacobs, Alan M.** Surficial deposits of St. Clair County, Illinois [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 390-391, 1970.

01343 **Jahns, Richard H.** Geologic hazards — Problems for joint solution: Jour. Geol. Education, v. 18, no. 2, p. 81-84, 1970.

Geologic features and events of danger to man and his works reflect nearly all known processes acting upon the Earth. The import of these hazards is becoming more visible and complex as a growing population makes increasing demands upon the natural environment. Often some of the hazards have evolved into disasters. In planning a given engineering project, a logical approach would comprise: (1) recognition and characterization of geologic hazards, (2) evaluation of risk associated with each of them, and (3) judgment of acceptable risk in terms of all factors pertinent to the project. The geologist is primarily responsible for the first step, cooordinating his work with that of engineers at this stage and as risk evaluations are made. When the final project is being judged in terms of acceptable risk, the geologist's contribution is completed. — *from* Author's abstract

08775 **Jahns, Richard H.** Long-term behavior of some major faults in southern California [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 382-384, illus., 1969.

Approximately 0.5 inches per year progressive right lateral movement is indicated throughout post-Oligocene time along the San Andreas fault northwest of "Big Bend." Cumulative slip during much of post-Oligocene time is indicated for the San Gabriel and San Andreas faults southeast of "Big Bend." — KAF

01078 **Janssens, A.** Preliminary report on the Sauk sequence in Ohio [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 391, 1970.

01197 **Jarman, Clara.** Effect of Tertiary intrusions on Cretaceous mudstones near Mitchell, Oregon [abs.]: Northwest Sci., v. 44, no. 1, p. 63, 1970.

Jeffrey, Lela M. *See* Rezak, Richard. 08439

Jensen, T. E. *See* McGinnis, L. D. 01084

08611 **Johnson, Arvid M.** Development of folds within Carmel Formation, Arches National Monument, Utah: Tectonophysics, v. 8, no. 1, p. 31-77, illus., 1969.

Fold patterns in the Carmel Formation are analyzed on the basis of simplified multilayer-folding theory. The pattern is an internal variety in which fold amplitudes diminish upwards and downwards from a maximum near the center of the formation. Maximum amplitudes either are displaced towards the base of the Carmel, indicating that lower beds were softer than upper, or folds extend upwards into the lower Entrada Sandstone where amplitudes gradually diminish. The two factors controlling this type of folding can be understood in terms of an inequality of form: $B/B_e (T)^3/2t_1$, where B is modulus of stiff beds of multilayer (Carmel), B_e modulus of confining medium (Entrada), T total thickness of multilayer, and t_1 thickness of each stiff bed of multilayer. If the inequality is satisfied, folding should be of general buckling variety in which folds extend into the Entrada; if not satisfied, folding should be of the internal variety. — VSN

01211 **Johnson, J. G.** Early Middle Devonian brachiopods from central Nevada: Jour. Paleontology, v. 44, no. 2, p. 252-264, illus., tables, 1970.

The brachiopod fauna now known from the early Middle Devonian (Eifelian) *Leptathyris circula* Zone of central Nevada includes 29 species. The zone contains assemblages representing two communities — a typical diverse assemblage, and a more restricted assemblage of the *Pentamerella* Subzone. Nine species from a *Pentamerella* Subzone community are described: *Teichertina americana*, *Spinatrypina recula*, *Anatrypa* (*Variatrypa*) *licta*, *Spinatrypa* (*Invertrypa*) *talis* are new. *Hadrorhynchia eurekaensis* Johnson is reassigned to *Cassidirostrum*. *Leptathyris circula* Zone brachiopods show strong affinity with Middle Devonian brachiopods of the Appalachian Province. — *from* Author's abstract

01212 **Johnson, J. G.; Boucot, A. J.** Brachiopods and age of the Tor Limestone of central Nevada: Jour. Paleontology, v. 44, no. 2, p. 265-269, illus., 1970.

The Tor Limestone of central Nevada carries an abundance of the smooth atrypid genus *Dubaria* belonging to a new species described here as *Dubaria megaeroides*. Previous assignment of the Tor Limestone to the Lower Devonian is rejected because the Tor appears to be pre-Gedinnian and probably is correlative with the Pridoli of Czechoslovakia and the Skala of Podolia. These stage names designate the highest Silurian beds in central Europe. — Authors' abstract

01176 **Johnson, John T.; Thrailkill, John.** Non-parametric analysis of variables influencing limestone groundwater occurrence [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 221-222, 1970.

Johnson, Johnnie F. *See* Gotautas, Vito A. 08455

01315 **Jones, Robert S.** Gold content of water, plants, and animals: U.S. Geol. Survey Circ. 625, 15 p., tables, 1970.

Sea water contains from 0.001 to 44 ppb gold. The amounts of gold in fresh surface waters and ground waters are also within this range. The following results are based on published neutron activation analyses: average amount of gold in sea water is 0.05 ppb; maximum amount of gold detected in plant ash is 36 ppm and average is about 7 ppm; and gold content of dry matter in animals ranges from 0.0012 to 430 ppb. On the basis of scanty analyses, terrestrial plants and animals appear to contain more gold than marine plants and animals. — RSJ

Jörgensen, Per. *See* Berry, Richard. 08703

08504 **Kaas, L. Michael.** Computer graphics — A new tool for exploration and mining, *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 9-22, illus., 1969.

The mineral industries are striving to expand their use of the computer's ability to process exploration, geologic, and mining data. Digital plotting programs and devices are continuing to gain wider use for lowering the cost and the time required to produce many types of maps and cross-sections commonly used by mining companies. Mineral engineers and geologists will soon be using a new tool, computer graphics, to greatly facilitate the use of computers to solve a large number of industry problems. By means of cathode-ray-tube (CRT) displays, an engineer can search large files of geologic data; display elevation contours, geologic structures, and ore grades; construct geologic and mining cross-sections; and compute tonnages for mining plans or ore reserve estimates. Examples of both digital plotting and cathode-ray-tube problem solving approaches are discussed in this paper. — Author's abstract

01146 **Kaesler, Roger L.** The cophenetic correlation coefficient in paleoecology: Geol. Soc. America Bull., v. 81, no. 4, p. 1261-1265, illus., 1970.

The cophenetic correlation coefficient measures distortion due to cluster analysis. Dendrograms from cluster analyses of hypothetical, nonhierarchical data show low cophenetic correlations. Ordination techniques based on factor analysis provide a better estimate of similarities among groups of stations when cophenetic correlation coefficients are low. — Author's abstract

01357 **Kaplan, I. R.; Presley, B. J.** Interstitial water chemistry, Deep Sea Drilling Project, Leg 2, [Chap.] 16 *in* Initial reports of the Deep Sea Drilling Project — V. 2, Leg 2 of cruises of *Glomar Challenger*, Hoboken, N. J., to Dakar, Senegal, Oct.-Nov. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 373, table, 1970.

Results of analyses of water in three samples from cores taken on Leg 2 are tabulated. — ESL

08543 **Kaplan, I. R.; Presley, B. J.** Interstitial water chemistry, Deep Sea Drilling Project, Leg 1, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D.C., U.S. Govt. Printing Office, p. 411-414, tables [1969?].

Water was squeezed out of 10 samples obtained from Holes 2, 3, 4, 6, 6A, and 7. The major cations were analyzed by atomic absorption spectroscopy, except sulfate, chloride, and bromide, which required other methods. Some consistent trends are apparent. Chloride-bromide ratios are good indicators of whether increase in concentration has occurred through concentration of sea water. Na, Mn, and Zn show enrichment over concentration in present-day sea water. Mg shows depletion except in Hole 2 on the Sigsbee Knoll. Ca shows quite large variations, greatest enrichment being in Hole 6. The greatest anomaly for Sr occurs in Hole 3 where an almost tenfold increase over concentration in sea water is indicated. In all samples, sulfate shows depletion relative to sea water. — ESL

08813 **Kauffman, Marvin E.** Transition from univariate to multivariate models, *in* Models of geologic processes, an introduction to mathematical geology — AGI/CEGS short course lecture notes, Philadelphia, 1969: Washington, D. C., Am. Geol. Inst., p. MK1 — MK42, illus., tables, 1969.

The purpose of analysis of variance is to determine how much of total variation among observations is due to variation in each such factor influencing the sample or the character being studied. In univariate analysis, a single variable affects a given population or sample; multivariate analysis involves more than one variable. Correlation and regression are treated briefly. An example illustrates analysis of mineral compositions of two samples from each of two regions to test whether there was any significant difference between the two areas in terms of the four minerals analyzed. The Susquehanna River terrace study was conducted to determine whether the different terraces actually represent different stages of glacial activity. — MCM

Keller, George H. *See* Bryant, William. 08456

Keller, Stanley J. *See* Carpenter, G. L. 08707

08604 **Kennedy, K. F.; Shillibeer, H. A.; Konen, C. E.** Log evaluation of Leg 1 of the Deep Sea Drilling Project, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D.C., U.S. Govt. Printing Office, p. 321-324, illus. [1969?].

The gamma-ray, resistivity, and density logs show definite correlative features. The large excursions of the density log may or may not reflect lithological variations depending upon the constancy of hole diameter. The large variations in counting rate do not necessarily reflect large changes in formation density since a logarithmic function probably relates bulk density and counting rate. When more bulk density data becomes available, it should be possible to calibrate the density log in terms of bulk density. — Authors' conclusions

01294 **Kennedy, Vance C.; Kouba, Dorothy L.** Fluorescent sand as a tracer of fluvial sediment: U.S. Geol. Survey Prof. Paper 562-E, p. E1-E13, illus., tables, 1970.

Stream sand coated with fluorescent paint was added at a constant rate, for 28 hrs., to Clear Creek at Golden, Colo., and the concentration of fluorescent grains monitored 810 m downstream. First-arrival time correlated with the square of grain diameter in the range 0.15-0.86 mm. Although the creek meanders gently, complete lateral mixing of fluorescent sand was not achieved within the study reach. Steady-state conditions apparently were achieved for finer particles, with highest concentrations on the north side and lowest on the south side of the stream; lateral mixing of coarser grains was much better than for finer grains. Sediment discharge computed from the tracer-dilution method was about 30 percent greater than suspended-sediment discharge computed from suspended samples for the 0.15-0.18 mm range and about 200 percent greater for the 0.38-0.52 mm range. — *from* Authors' abstract

08563 **Kent, Bion H.** Geologic map of part of the Carmichaels quadrangle, southwestern Pennsylvania: U.S. Geol. Survey Misc. Geol. Inv. Map I-588, scale 1:24,000, section, text, 1969.

Coal has been mined in the Carmichaels quadrangle, principally from the Pittsburgh and Waynesburg beds. Gas wells on the Brownsville anticline and on the west limb of the Port Royal syncline have produced from several sandstones of Pennsylvanian, Mississippian, and Devonian age, but oil production has been very small. Limestone in the Sewickley Member of the Pittsburgh Formation has been quarried for road surfacing and agricultural lime. Sandstone in the lower member of the Waynesburg has been quarried for local use. Clay and mudstone have been used for making brick and pottery. — MCM

08790 **Kent, Bion H.** Geologic map of the Mather quadrangle, southwestern Pennsylvania: U.S. Geol. Survey Geol. Quad. Map GQ-826, scale 1:24,000, section, text, 1969.

Resources of economic interest in the Mather quadrangle are: coal principally from the Pittsburgh and Waynesburg beds, but now mined out to a great extent; gas from several sandstones of Pennsylvanian, Mississippian, and Devonian age, but production has been small; limestone from several formations, that of the Washington Formation being purest and most valuable; sandstone which was quarried locally but now valuable mainly as a potential source of water for domestic and stock use; and clay from mudstone units for brick manufacture. New industrial demands may utilize limestone for quicklime and lime products and coal for steam coal and sulfur as a byproduct. — MCM

01302 **Kheradpir, Ahmad.** Foraminiferal trends in the Quaternary of Tanner Basin, California: Micropaleontology, v. 16, no. 1, p. 102-116, illus., 1970.

Two distinct planktonic foraminiferal faunas alternate throughout three cores from Tanner Basin, a cold-water or subarctic fauna dominated by left-coiling *G. pachyderma* and a warmer-water or transitional fauna characterized by right-coiling *G. pachyderma* associated with additional planktonic species. During deposition of the core sediments, subarctic water masses expanded into southern California at least twice, alternating with two periods of warmer water, including the present. Varia-

tions in absolute numbers of planktonic foraminifera and radiolarians in the sediments reflect changes in rates of sedimentation. Benthonic foraminifera will occur in greater abundance in association with the cooler-water planktonic foraminiferal faunas probably due to the lowering of sea level. — *from* Author's abstract

08614 **King, C. A. M.** Some Arctic coastal features around Foxe Basin and in E Baffin Island, N.W.T. Canada: Geog. Annaler, v. 51A, no. 4, p. 207-218, illus., tables, 1969.

Raised coastal features in west Baffin Island include beach ridges of fairly well-rounded stones compared with stones of the modern beach. Foley Island, off west Baffin Island in Foxe Basin, has two main series of beach ridges, ranging in height from 93-68 m and 65-40 m, and time periods from 6,800-5,600 B.P. and 5,500-4,800 B.P., respectively. A hiatus between the two series when sea level stood between 65 and 70 m, allowed a complex fan pattern of ridges to form. The modern sand beach was surveyed before and after ice break-up to illustrate its character and the effect of weak wave action in modifying the influence of shore ice. Chevron beach ridges are discussed mainly from evidence of air photographs. Finally some beach features and [illegible] coasts are compared. — from Author's abstract

08736 **King, R. U.** Molybdenum, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 158-163, illus., table, 1969.

Molybdenum deposits are concentrated largely in the Blue Mountains in the northeastern part of the State and in the Klamath Mountains in southwestern Oregon. Production has been small, and potential for significant production appears to be very limited. Areas that appear most promising include the Elkhorn-Greenhorn areas in the Blue Mountains, the Klamath Mountains, and the Wallowa Mountains. — MHM

08786 **Kisslinger, Carl.** Spectral analysis of *P*-waves at short range as an indicator of focal parameters [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 403-404, 1969.

The spectra of P-waves recorded within 10 km of the focus of earthquakes of the Matsushiro swarm has been examined in an effort to determine if a relationship could be found between the predominant frequencies in the P-wave and the parameters of the focus. Parameters considered are magnitude and depth of focus, position of focus in the swarm region, and the time of occurrence during the swarm. — KAF

08601 **Kleinkopf, M. Dean; Peterson, Donald L.** The U.S. Geological Survey's gravity program in the Rocky Mountain and Basin Range areas, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 529-531, illus., table, 1969.

Most of the gravity surveys of the U.S.G.S. have been support programs in connection with regional geologic structure studies, ground-water investigations, and heavy metals exploration. The Survey's gravity activities since 1964 in Montana, Idaho, Wyoming, Colorado, Utah, Nevada, New Mexico, and Arizona, and gravity surveys presently in progress are summarized in tables. Most work has been done with Worden and LaCoste-Romberg gravimeters. Computer techniques have recently been employed in interpretations. Several examples of the application of gravity studies to regional structural investigations are cited as well as work on low-density valley fill depths in western Montana and the heavy-metals program. — GV

01221 **Kohland, William Francis.** Soils of Erie and Jefferson Counties, Pennsylvania — A geographic study and comparison of the distribution and utilization of soils in a glaciated and a non-glaciated area [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3453B, 1970.

01271 **Konen, C. E.; Helander, D. P.** A computer analysis of shaly sands using multiple porosity logging devices: Log Analyst, v. 11, no. 1, p. 3-12, illus., 1970.

Providing that total responses of logging devices can be adequately described, the solution of a system of linear equations representing neutron, density, and velocity log responses, plus an additional equation based upon the SP or gamma ray, appears to provide a satisfactory solution for evaluation of effective porosity of argillaceous material. The shaly sand model is not an explicit solution for the quantities of shale, sand, clay and porosity, but a trial and error procedure which allows consideration of more than one type of clay, flushed zone gas saturation, and another mineral component. Results of calculations are not specific quantities but a range of values for porosity, shale, and clay percentages. Although values of porosity are relatively insensitive to clay type, matrix velocity, and compaction correction, the latter coefficient does affect the computer percentages of shale and clay. — *from* Authors' abstract

Konen, C. E. *See* Kennedy, K. F. 08604

Koons, C. B. *See* Rogers, M. A. 08478

Kouba, Dorothy L. *See* Kennedy, Vance C. 01294

08783 **Kovach, Robert L.; Breiner, Sheldon.** Recent progress on a magnetometer array on the San Andreas fault [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 399, 1969.

08811 **Krumbein, W. C.** Sequential modelling and population densities in geology, Lecture 1 *in* Models of geologic processes, an introduction to mathematical geology — AGI/CEGS short course lecture notes, Philadelphia, 1969: Washington, D. C., Am. Geol. Inst., p. WCK-A1 — WCK-A14, tables, 1969.

A model may be defined as a device for structuring observational data so that questions being asked can be answered; it is used to test validity of intuitive judgment or validity of the theoretical basis on which the model is constructed. As additional variables are introduced, the complexity of the model increases rapidly. In geological observations there are inherent differences between geological objects, which added to the inherent measurement and sampling errors of all statistical data set the pattern for procedures. An important part of geological analysis is to identify the population density by testing sample data. Tables show a classification of geological models, a schematic arrangement of stages in a geological study, and a check list of some population models used in geology for discrete populations and for continuous distributions. — MCM

08812 **Krumbein, W. C.** Deterministic and probabilistic models in geology, Lecture 2 *in* Models of geologic processes, an introduction to mathematical geology — AGI/CEGS short course lecture notes, Philadelphia, 1969: Washington, D. C., Am. Geol. Inst., p. WCK-B1 — WCK-B14, illus., 1969.

The complexity of geological processes almost excludes the cause-and-effect approach to problem solving; prediction changes from an exact deterministic statement to a probabilistic statement, which changes the model to a stochastic model which may still retain a core of determinism. In a stochastic model the outcome of an experiment is controlled by the probabilities associated with an underlying set of possible outcomes, and the underlying process is appropriately referred to as a random process. Some random processes are independent events, but some depend upon earlier events, i.e., the Markov chain. A given micro-effect may be controlled by more than one micro-cause, with no specific evidence of which particular cause is responsible; an example is given of the initiation of a bifurcation at the head of a growing first-order stream channel. A Markov model is used to illustrate patterns of stratigraphic succession. — MCM

08706 **Kuba, Edward M.** A hydraulic model study of landslide-generated water waves in bays: Shore and Beach, v. 37, no. 1, p. 49-54, illus., 1969.

There have been numerous instances of generation of giant waves by landslides falling into bays, lakes, inlets, and reservoirs. Research in this field has been confined mainly to theoretical and laboratory studies. The primary objective of this study was

to predict the height of a wave from the parameters that govern it. The study was confined to nonbore-type waves generated by submerged landslides down a slope. Waves were created by boxes of various weights sliding down an incline. Three different slope conditions were investigated. It appeared possible to determine the initial crest height of a wave generated by a landslide falling down a slope, by knowing the depth of water into which it fell, and the *x*-components of velocity and of the distance through which the landslide moved. — ESL

08587 **Kuck, Peter.** Neutron activation analysis of primary molybdenum, titanium and tungsten minerals from the porphyry copper environment [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 34-35, 1969.

01132 **Kugler, Hans G.** Vincent Charles Illing (1890-1969): Am. Assoc. Petroleum Geologists Bull., v. 54, no. 3, p. 542-544, portrait, 1970.

08492 **Kuhl, G. H.** Synthetic phillipsite: Am. Mineralogist, v. 54, nos. 11-12, p. 1607-1612, illus., tables, 1969.

Zeolite ZK-19 synthesized by phosphate complexing, with molar SiO_2/Al_2O_3=4 to 16 and $Na_2O/(Na_2O+K_2O)$=0.3 to 0.85, has X-ray diffraction patterns nearly identical to natural phillipsites. The structure is destroyed by heating at 350°C. — Author's abstract

Kulm, L. D. *See* Duncan, John R. 01122

Kulm, L. D. *See* Griggs, G. B. 01349

01272 **Kumar, J.; Fatt, Irving.** Nuclear magnetic resonance study of porosity, permeability and surface area of unconsolidated porous materials: Log Analyst, v. 11, no. 1, p. 13-16, illus., table, 1970.

A study of relaxation time as a function of permeability, specific surface, and porosity was made under dynamic conditions of fluid flow. A linear relationship was found between relaxation time and specific surface grains and an exponential relationship was found between permeability and relaxation time. No definite relationship was observed between porosity and relaxation time. This study may help in the development of new laboratory and in-situ techniques for the measurements of specific surface of particles and permeability of porous media. — Authors' abstract

Kunasz, Ihor A. *See* O'Neill, Bernard J. 08663

01144 **LaFountain, Lester J.** Plotted and point-counted stereograms by computer X-Y plotter or microfilm devices: Geol. Soc. America Bull., v. 81, no. 4, p. 1267-1271, 1970.

A procedure has been developed to plot orientation data making use of the incremental plotter and microfilm devices found on many computer systems. The program has been written to plot data on an equal area projection, to count the plotted points, and to plot the point counts on an equal area projection for contouring. Plotting can be done on either an incremental plotter or on a microfilm device. The advantage of these devices is in the production of complete stereograms with accurately plotted data points. The program is executed in the form of one main program which calls several subroutines. The main program reads in the data and selects the output device to be used. The data are assigned coordinates on the stereogram and point counted by subsequent calls from the main program to the several subroutines. — Author's abstract

Lalou, C. *See* Duplessy, J. C. 01289

08553 **Lamb, James L.** Planktonic foraminiferal datums and late Neogene epoch boundaries in the Mediterranean, Caribbean, and Gulf of Mexico, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 559-578, illus., 1969.

Late Neogene planktonic foraminiferal datums and epoch boundaries in Italy are compared with those in the Caribbean and Gulf of Mexico. Datums recognizable in these regions include appearance of: *Globorotalia margaritae* in early Pliocene, *G. crassaformis* lineage in middle Pliocene, *G. tosaensis* and *Sphaeroidinella dehiscens* in very late Pliocene, and *G. truncatulinoides* in early Pleistocene. Initiation of the Pleistocene is recognized by abrupt climatic deterioration and marked eustatic lowering of sea level. Paleontologic, paleoclimatic, eustatic records, and geomagnetic dating of earliest Pleistocene glacial rocks favors a Pleistocene epoch beginning at 2.5 to 3.0 m.y. ago. This corresponds to extinction of *Globoquadrina altispira* and withdrawal of the warm-water species from the Caribbean and Gulf of Mexico. — *from* Author's abstract

Land, P. E. *See* Anderson, David N. 01164

Lane, N. Gary. *See* Webster, G. D. 01214

01152 **Laney, R. L.** Quality of water, *in* Objectives, methods, and environment — Gila River Phreatophyte Project, Graham County, Arizona: U.S. Geol. Survey Prof. Paper 655-A, p. A21-A22, 1970.

Water from each of the four major hydrologic environments in this area has identifiable characteristics. Dissolved-solids content of Gila River varies inversely with discharge — less than 500 mg per liter at high flow (sodium bicarbonate type) to more than 4,000 at low flow (sodium chloride type); most of the year, sodium and chloride are the principal ions. Major tributary flow, sodium bicarbonate in type, contains less than 400 mg per liter dissolved solids. In water from 56 observation wells that tap alluvium, sodium, chloride, and sulfate are the principal constituents, ranging from 1,000 to 20,000 mg per liter dissolved solids. In water from 10 wells tapping basin fill, generally calcium-sodium bicarbonate type, dissolved solids average 411 mg per liter, a range of 214 to 847. Floodflow controls may obscure effects of changes in amounts of phreatophytes. — GDC

08664 **Langmuir, Donald.** The chemistry of ground and surface waters in Nittany Valley: Earth and Mineral Sci., v. 38, no. 9, p. 73-74, 1969.

Nittany Valley, locale of the University Park Campus of Pennsylvania State University, is underlain by folded and faulted carbonate rocks, and bounded and divided by sandstone-quartzite and shale. An extensive appraisal of water quality, based on samples from 150 wells, springs, and streams, has been undertaken. Water in the carbonate-rock area is hard to very hard due to solution of calcite and dolomite. The calcium-magnesium ratio gives information about the source rock. Ground waters are usually higher in dissolved solids and carbon dioxide, and lower in pH and dissolved oxygen than surface water, and the temperature is more constant. The degree of saturation with calcite and dolomite provides an insight into the water's age and history. — ESL

Lao, Chester. *See* Peterson, Frank L. 01155

01079 **Laporte, Leo F.** Paleontology — Fossils and environment [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 391-392, 1970.

08564 **Larrabee, David M.** Serpentinite and rodingite in the Hunting Hill quarry, Montgomery County, Maryland: U.S. Geol. Survey Bull. 1283, 34 p., illus., tables, geol. map, 1969.

The Hunting Hill pluton, 1 mile wide and 4 miles long, consists of serpentinized dunite cut by gabbro dikes altered to rodingite. It is exposed in the active quarry of Rockville Crushed Stone, Inc., 4 miles west of Rockville, Md. This quarry, mapped in 1966, is centered within the pluton and trends N. 45° E. Forty-seven minerals have been identified. The pluton, of probable Ordovician age, was intruded into the Wissahickon Formation of late Precambrian (?) age. The serpentinite ranges from dull green through gray to black and is largely antigorite. The rodingite ranges in shape and size from lenslike bodies a few feet long to irregular, branching dikelike masses as much as 1,500 feet long and 100 feet wide. It is composed of bright-green chromi-

an diopside, cinnamon-colored grossularite, white diopside, zoisite, and small amounts of other minerals, including prehnite and hydrogrossularite. — DML

Larsen, Leonard H. *See* Rowan, Lawrence C. 01180

Larson, R. J. *See* Bradshaw, L. E. 01056

Lattimore, R. K. *See* Weeks, L. A. 08530

01186 **Lattman, Laurence H.** Geological instruction in remote sensing [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 392, 1970.

08709 **Leakey, L. S. B.; Goodall, Vanne Morris.** Unveiling man's origins — Ten decades of thought about human evolution: Cambridge, Mass., Schenkman Publishing Co., 220 p., illus., 1969.

This book is an outgrowth of a lecture series presented since 1960 on the gradual growth of knowledge of human evolution; its aim is to present some background concerning the many changes of opinion, and the setting up and discarding of theories which have taken place, especially since Darwin. The book is in two parts: (1) a background of events which have a bearing on the topics up to the year 1859; (2) ten successive chapters, each of which covers one decade since 1859. A brief epilog points to the vast amount of research that remains to be done and highlights some of the principal problems facing prehistorians. The book is intended primarily for college students, but should be of interest to the general public. — MCM

Lee, Clyde. *See* Gotautas, Vito A. 08455

01149 **LeGrand, Harry E.** Comparative hydrogeology — An example of its use: Geol. Soc. America Bull., v. 81, no. 4, p. 1243-1248, illus., table, 1970.

General hydrologic settings should be classified. Classification would allow discernment of processes and principles appropriate to understanding of general hydrology of the terranes. The Black Belt (chalk of Selma Group) of the Coastal Plain of Alabama and Mississippi and an area underlain by gabbro in the Piedmont Province, North Carolina, despite different petrology, are hydrologically similar having low topographic relief, low water-table gradients, high evapotranspiration, thin soils, low base flow of streams, and other characteristics in common. From these examples, the concept of comparative hydrogeology is developed as analogous to the type-section concept in stratigraphy. A taxonomic arrangement of hydrogeologic environments should be developed. — JHF

01236 **Lent, Robert Louis.** Geology of the southern half of the Langlois quadrangle, Oregon [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3708B-3709B, 1970.

08585 **Leskinen, Paul.** Late Pleistocene vegetation change in the Christmas Tree Pass area, Newberry Mountains, southern Nevada [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 27-28, 1969.

08471 **Leutze, W. P.** Significance of Pliocene stratigraphic paleontology, Gulf Coast [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 503, 1969.

08437 **Levert, Charles F., Jr.; Ferguson, Hershal C., Jr.** Geology of the Flower Garden Banks, northwest Gulf of Mexico, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 89-100, illus., 1969.

The Flower Garden Banks, located 130 miles south-southeast of Galveston, Texas, are the most prominent of a series of topographic highs in the northwest Gulf of Mexico and have been noted and studied for years. These physiographic expressions are related to salt uplift and biohermal development. The results of this study demonstrate that biohermal development during the present interglacial period occurred in

a deep water environment in the northwest Gulf of Mexico. This raises the possibility of the existence of buried fossil reefs which formed within structural and depositional environments similar to those existing today on the outer continental shelf. If these fossil reefs do exist they offer a previously unrecognized exploratory objective on known structural features. — Authors' abstract

01284 **Levi-Donati, G. R.** Micro-chondrules: Meteoritics, v. 5, no. 1, p. 33-42, illus., 1970.

Very small chondrules, which are less than 250 μ in size and are referred to as microchondrules, were discovered in twelve chondritic meteorites. The morphology, composition, and structure of these microchondritic bodies are investigated. In particular, the description of the principal, minor, and accessory minerals is given in some detail. Microphotographs are presented which show the internal texture of the bodies and the integration between matrix and microchondrules. Several porphyritic microchondrules are completely surrounded by opaque minerals, and here the matrix-chondrule integration is practically absent. A possible evolutionary sequence for microchondrules is discussed. — Author's abstract

08704 **Levin, Ernest M.; Robbins, Carl R.; McMurdie, Howard F.; Reser, Margie K.** (compilers and editor). Phase diagrams for ceramists, 1969 supplement: Columbus, Ohio, Am. Ceramic Soc., 625 p., illus., 1969.

Supplementing the collection published in the 1964 revised edition, this latest volume contains 2,083 phase diagrams of oxide, salt, and sulfide systems, 70 percent of which have been published since 1960. Salt systems have increased in importance because of their application to nuclear technology; most phase studies are found in Russian literature. Special effort has been made to complete their coverage and to include hydrothermal and pressure diagrams. No evaluation of the accuracy of the selected diagrams was made; obvious errors and violations of classical thermodynamic principles usually have been corrected. Phases of fixed composition on a diagram indicate that no variability was detected or that the extent of solid solution was too small to be indicated on the compositional scale. Author and subject indexes cover all diagrams for both volumes; the figure numbers for this volume, starting with 2067, are in bold-faced type. — GDC

01172 **Levy, John S.; Logan, Thomas F.; Woolsey, James R.** Potential applications of infrared aerial photography to sedimentary processes [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 228-229, 1970.

08588 **Lewis, Charles F.; Buseck, Peter R.; Moore, Carleton B.** The Wikieup, Arizona stony meteorite [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 35, 1969.

08589 **Lewis, Charles F.; Moore, Carleton B.** A reinvestigation of the Camp Verde, Arizona iron meteorite [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 35, 1969.

08850 **Li, Yuan-Hui; Bischoff, James; Mathieu, Guy.** The migration of manganese in the Arctic basin sediment: Earth and Planetary Sci. Letters, v. 7, no. 3, p. 265-270, illus., table, 1969.

A relatively high content of manganese at the top of an arctic sediment core and a smooth exponential increment of manganese concentration in its interstitial water down to one meter have been found. The data strongly support the idea that manganese may be remobilized after burial by local reducing conditions. The thermodynamic calculation shows that the interstitial water is reaching chemical equilibrium with respect to $MnCO_3$ precipitate in the deeper part of the sediment. — Authors' abstract

Liebermann, Robert C. *See* Molnar, Peter. 01298

08685 **Limón Gutiérrez, L.** Aplicaciones del metodo de conteo por fluorescencia de rayos X en estudios geológicos: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 5-30, illus, tables, 1969.

The author discusses the X-ray fluorescence method, which was used in studying samples from 4 oil wells in the Comalco district in the state of Tabasco, Mexico. The results of the study, which are shown graphically, indicate a close correlation with stratigraphic columns of the wells. — EH

01080 **Lindstrom, Maurits.** On the affinities of the conodonts — A review of existing knowledge [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 392-393, 1970.

Lineback, Jerry A. *See* Collinson, Charles. 01064

01081 **Lineback, Jerry A.** Calcarenite and shallow-water carbonate facies of the Salem and St. Louis Limestones (Mississippian) in Illinois [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 393, 1970.

Lipps, Lewis. *See* Ray, Clayton E. 01329

08838 **Lisitsyn, A. I.** Metallogeniya Kuby [The metallogeny of Cuba]: Sovet. Geologiya 1969, no. 11, p. 62-77, 1969.

Cuba is a folded region consisting of a eugeosynclinal and a miogeosynclinal area separated by the main Cuban fault. Widely developed porphyritic and spilite formations of ultrabasic rocks, diorites and granodiorites are characteristic of the eugeosynclinal zone. Several magmatic formations are related to definite stages of geosynclinal development. Magmatic, lithologic and tectonic factors controlling mineralization are discussed. On the attached metallogenic map, based on tectonics, are shown main structures and mineral deposits, classified genetically. Commercial deposits are described as well as the distribution of known and potential ore areas. — EH

Lisitzyn, A. P. *See* Rateev, M. A. 08692

08511 **Lloyd, Joel J.** A program for an information center in the earth sciences, *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 311-317, 1969.

Present storage and retrieval of geological information is so diverse that a common language and common practice is needed. Interfacing is neither practical nor economic in the handling of English language information. Whether a single input/output center or a locus of interlocking subcenters is established is irrelevant; the capture of fugitive information and recapture of lost data is paramount. Immediate action is indicated; the cost of rectifying immediate mistakes may be far less than the delayed execution of a long studied plan. In this paper, system designs are considered in terms of input elements and output products, various mechanical operating modes are presented, and economics of organization and maintenance are discussed. — *from* Author's abstract

Lloyd, Orville B., Jr. *See* Wyrick, Granville G. 08848

Logan, Thomas F. *See* Levy, John S. 01172

01148 **Loney, Robert A.** Faulting in the Burro Mountain area, California Coast Ranges, and its relation to the Nacimiento fault: Geol. Soc. America Bull., v. 81, no. 4, p. 1249-1254, illus., 1970.

The northwest-striking Nacimiento fault has generally been regarded as the boundary between the Nacimiento block to the southwest, in which the basement rocks belong to the Franciscan Formation (Upper Jurassic to Upper Cretaceous), and the Salinian block to the northeast, in which the basement rocks are granitic and high-grade metamorphic. However, in the Burro Mountain area, southern Santa Lucia Range, the "Nacimiento" fault of Jennings (1959) is nearly vertical and is within the Nacimiento block. Here, the Franciscan Formation crops out northeast of the "Nacimiento" fault through windows in an older, low-angle thrust fault that brings the Asuncion Group of Taliaferro (1943) (Upper Cretaceous) over the Franciscan For-

mation. The fault boundary between the Nacimiento and the Salinian blocks must therefore lie farther to the northeast, where it may be buried beneath the Asuncion Group and younger strata. — RAL

01324 **Long, Sumner.** Identification of paleodispersal centers for deltaic sediments [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s21-s22, 1970.

08634 **López Gómez, O.** Estudio bioestratigráfico y paleoambiental en la porción central del área de Comalcalco, Tab. [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 87, 1969.

08643 **López Ticha, D.** Evaluación petrolífera de la Cuenca de Tlaxiaco [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 91, 1969.

01254 **Lorshbough, A. L.** Clarksburg gas field: California Oil Fields — Summ. Operations 1969, v. 55, no. 1, p. 31-37, illus., tables, 1970.

In Clarksburg gas field (southeastern Yolo County) 12,000 feet of sedimentary rocks, ranging in age from Holocene to Upper Cretaceous, have been penetrated. The sequence of deposition is broken by three disconformities and by the Markley Gorge, an unusual erosional feature trending southwest, adjacent to the western limit of production. The field is on the northern portion of a homocline, limited to the north, south, and east by major systems of lateral faults; minor faults within the field's limits, together with edge water and facies changes, control accumulation and production. The occurrence of gas in the Pollock and Forbes sands is erratic; sands are poorly defined and lenticular. During 1968 the field produced about 69,000 Mcf of gas. — MCM

01293 **Love, J. D.** Cenozoic geology of the Granite Mountains area, central Wyoming: U.S. Geol. Survey Prof. Paper 495-C, p. C1-C154, illus., tables, geol. maps, 1970.

The Granite Mountains are a major Laramide upfold progressively buried during Cenozoic time. Downwarping and downfaulting of the mountain core prior to regional degradation preserved a remarkably complete record of Cenozoic sedimentation and tectonism that, on adjacent ranges, was destroyed by exhumation. Maximum thicknesses in feet of strata on the crest or flanks of the Granite Mountains are: Paleocene, 3,000; lower Eocene, 6,000; middle and upper Eocene, 700; Oligocene, 800; Miocene, 3,000; Pliocene, 1,300; Pleistocene, 150. Isopach and structure contour maps and block diagrams depicting various stages in Cenozoic history utilize data from several hundred wells and surface sections. The geologic history is used in interpretation of origin and in economic evaluation of uranium, oil and gas, coal, jade, and other resources. — JDL

Lövseth, Knut. *See* Nydal, Reider. 01337

01335 **Lowdon, J. A.; Blake, W., Jr.** Geological Survey of Canada radiocarbon dates IX: Radiocarbon, v. 12, no. 1, p. 46-86, tables, 1970.

All descriptions are on geologic samples from Canada. Tabular information includes average background and standard counting rates for 12 months (1967-68), comparison of ages at different pressures in a 5-L counter, tests on bone contamination by varying pretreatment, and tests for C-14 contamination. — MCM

01198 **Lowther, J. Stewart.** Silica sandstones in the Swauk formation near Wenatchee, Washington [abs.]: Northwest Sci., v. 44, no. 1, p. 65, 1970.

01237 **Luce, Robert William.** Dissolution of magnesium silicates [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3709B, 1970.

08803 **Luehrmann, William H.** Seismic profiling systems: Oceanology Internat., v. 4, no. 6, p. 44-47, illus., table, 1969.

Technological advances have now made it possible to conduct seismic profiling in deep water at near-maximum vessel speeds. New hardware includes many good non-dynamite sound sources, detector cables with hydrophone arrays that cancel unwanted noise and enhance seismic "echoes", on-board profile monitoring recorders which instantly display subbottom geology, and magnetic tape recorders with analog and digital capability. Pneumatic, gas, electric discharge, displacement-type, dynamite, low-power, and swept frequency sound sources are described briefly and listed in a table; improvements in detector cables and techniques of data processing to improve quality are discussed also. — VSN

01199 **Lund, Ernest H.** Origin of nonporphyritic selvages in porphyry intrusions [abs.]: Northwest Sci., v. 44, no. 1, p. 65, 1970.

08655 **Lund, Ernest H.; Baldwin, Ewart M.** Diorite intrusions between Sixes and Pistol Rivers, southwestern Oregon: Ore Bin, v. 31, no. 10, p. 193-206, illus., 1969.

Many small stocks and irregularly shaped plutons of dioritic composition are present between these river valleys in Curry and Coos Counties. The plutons have been of interest as a possible source of gold. Most of the intrusions were emplaced during the Nevadan orogeny, and correlate with the Pearse Peak pluton in age and composition. All rocks examined are hydrothermally altered. Modes of quartz diorites are tabulated, and represent the original rock composition. Mineralogy of 12 plutons is described. Dike-like bodies of dacite, possibly apophyses of larger plutons, also occur in the area. Altered gabbroic intrusions are described also. The author believes these plutons were intruded after emplacement of serpentine. — CSL

Luternauer, John L. *See* Garrison, Robert E. 08695

08833 **Luzier, J. E.** Geology and ground-water resources of southwestern King County, Washington: Washington Dept. Water Resources Water-Supply Bull. 28, 260 p., illus., tables, geol. map, 1969.

On a drift plain west of the glaciated foothills of the Cascade Range, bedrock surface descends beneath Quaternary deposits over 1,000 feet thick; Tertiary rocks are all too fine-grained to yield more than 50 gals water per min. Ground water is confined in most Pleistocene aquifers older than Vashon till and unconfined in recessional outwash and most alluvial aquifers; springs from thick ice-contact and recessional outwash may discharge 1,000 to 20,000 gpm each. Beneath Duwamish Valley, a former marine embayment, fan deposits coalesce in a 15-mi fill 400 feet thick. A lobe of the Osceola Mudflow, C-14 dated at 5,000 yr, is buried in this near Kent, 65 mi from its Mt. Rainier source. Fan alluvium beneath was deposited by the Green and Cedar Rivers, that above by the White River. With proper management, increased water demands in this valley can be met fully. — GDC

01295 **Lynts, George W.** Conceptual model of the Bahamian Platform for the last 135 million years: Nature, v. 225, no. 5239, p. 1226-1228, illus., 1970.

The subsidence history of the Bahamian Platform points to a nonuniform rate of seafloor spreading since the beginning of the Cretaceous. Lower Cretaceous rates of perhaps 5 cm per yr led to an active trench system at the boundary between the American and Caribbean lithosphere plates, and the rapid subsidence of the continental margin produced graben faults on the Bahamian Platform and normal faults in Cuba. — Author's abstract

01163 **Mabey, Don R.; Oriel, Steven S.** Gravity and magnetic anomalies in the Soda Springs region, southeastern Idaho: U.S. Geol. Survey Prof. Paper 646-E, p. E1-E15, illus., geol. map, 1970.

Major gravity lows indicate the presence of deeply filled troughs in Gem and Bear Lake Valleys. A large and compound gravity low may record a collapsed igneous structure at China Hat. Relative uniformity of gravity values in the eastern or Middle Rocky Mountain part of the region indicates that strike valleys in the folded and thrust belt contain little detrital fill. The gravity survey also indicates that, although

large regional topographic features are isostatically compensated, the region in general is undercompensated. Most of the major magnetic anomalies are attributable to volcanic features evident on the surface and to structures inferred therefrom. Two positive magnetic anomalies of undetermined origin are at Eighteenmile Creek in the Chesterfield Range. — DRM

MacDonald, Robert D. *See* Garrison, Robert E. 08695

08818 **MacDonald, William D.; Melson, William G.** A late Cenozoic volcanic province in Hispaniola: Caribbean Jour. Sci., v. 9., nos. 3-4, p. 81-91, illus., tables, 1969.

Limburgite flows unconformably overlie folded Miocene strata near San Juan, Dominican Republic. In chemistry, petrology, and mode of occurrence they are similar to flows of nepheline basalts and related rocks of Pleistocene? age in south-central Haiti. Together these occurrences define the Hispaniola alkaline mafic volcanic province. Their distribution along an east-west trend through south-central Hispaniola suggests an origin related to deep-seated east-west late Cenozoic fractures through the Greater Antilles. — Authors' abstract

MacLeod, N. S. *See* Snavely, P. D., Jr. 08717

MacLeod, Norman S. *See* Snavely, Parke D., Jr. 08649

01325 **Madeley, Hulon M.** A tentative interpretive stratigraphy of the pre-Womble Shale section of the Ouachita Mountains [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s22, 1970.

01334 **Madeley, Hulon M.** Make geology relevant! [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s47, 1970.

Magill, E. A. *See* Hobbs, S. W. 08740

Mahan, S. *See* Rogers, J. J. W. 01171

Maher, Stuart W. *See* Finlayson, C. Pratt. 08554

08778 **Major, M. W.; Romig, P. R.** Secular strain and earthquakes near Denver [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 385-387, illus., 1969.

Certain gross features of the active earthquake zone around Denver and strain variations since November 1967 at a point in the active zone are described. A source mechanism for the largest event to date, August 9, 1967, is described. – KAF

08581 **Malahoff, Alexander; Erickson, Barrett H.** Gravity anomalies over the Aleutian trench, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 552-556, illus., 1969.

Data from 48 crossings of the Aleutian trench between long 165° and 180° W. provide a basis for a free-air gravity map, a Bouguer gravity map, and, with available seismic data, suggest: (1) The smooth oceanic crust 150 km north of the Aleutian trench axis has an average depth of 4500 m and an associated free-air anomaly of +50 mgal, (2) free-air gravity anomalies and bathymetric features of the Aleutian trench parallel one another, (3) a +150 to +200-mgal relative Bouguer low is located over the bench, and (4) interpretation of the free-air and Bouguer anomalies suggests an oceanic crustal thickness of 10.6 km at 75 km south of the axis, a 14.5-km crust under the trench axis; and, probably, a low-density upper mantle at 45 km north of the axis. — GV

Malik, W. U. *See* Gupta, G. C. 08494

Malpica Cruz, R. *See* Téllez, C. 08679

Mamay, Serglus H. *See* Churkin, Michael, Jr. 08672

08542 **Manheim, F. T.; Sayles, F. L.; Friedman, Irving.** Interstitial water studies on small core samples, Deep Sea Drilling Project, Leg 1, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 403-407, illus. [1969?].

The most dramatic variations in pore water composition occurred in Holes 2 and 3 in the Gulf of Mexico. Both holes showed a strong increase in salinity with depth, evidently owing to diffusion from underlying salt bodies. However, on Challenger Knoll (Hole 2) a sharp drop in salinity was observed in the cap rock of the salt dome in which chloride fell to only 4.8 percent. The drop is attributed to production of fresh water during the formation of native sulfur. Outside of the Gulf of Mexico, changes in total salinity with depth did not exceed a few percent, but differences in diagenetic modification of the ionic ratios of sea water were pronounced. In nondiapiric strata in the Gulf of Mexico (Hole 1) both magnesium and potassium were depleted in the pore waters, whereas in the open ocean holes (4, 5, 6, and 7), potassium appeared in excess. Water content (porosity) of the cores was irregular. — Authors' abstract

08474 **Manker, J. P.; Griffin, G. M.** Distribution of silicate minerals in Florida Bay [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 505, 1969.

Manker, J. P. *See* Griffin, G. M. 08526

Manley, F. H. *See* Martin, B. F. 01326

01333 **Manley, F. H.** Chlorite polytypism in the migmatitic Piedmont belt of northwestern South Carolina [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s25, 1970.

Marine, I. W. *See* Webster, D. S. 01370

01376 **Marlow, M. S.; Scholl, D. W.; Buffington, E. C.; Boyce, R. E.; Alpha, Tau Rho; Smith, P. J.; Shipek, C. J.** Buldir Depression, a late Tertiary graben on the Aleutian Ridge, Alaska: Marine Geology, v. 8, no. 1, p. 85-108, illus., table, 1970.

Buldir Depression, on the northern edge of the Aleutian Ridge, is aligned with the active volcanoes on the ridge crest. The depression is a graben formed by extensional rifting and accompanied by contemporaneous volcanism on the Aleutian Ridge. Subsidence rates for the depression are estimated at 20-70 cm/1,000 yr. Sediments in the depression are 300 m thick and are probably pelagic and turbidite deposits of Pleistocene age. Older sediments on the Aleutian Ridge have a maximum thickness of 550 m and are deformed and slumped toward the Bering Sea. These sediments are postulated to overlie a midflank terrace on the northern Aleutian Ridge that tilted to the north during formation of Buldir Depression. — *from* Authors' abstract

08462 **Marszalek, Donald S.; Wright, Ramil C.; Hay, William W.** Function of the test in Foraminifera, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 341-352, illus., 1969.

Electron microscope studies of the spatial relations of foraminiferal tests and living organisms indicate: (1) most primitive tests are constructed of arenaceous material to provide weight to counteract bouyancy of the protoplasm; (2) elaboration of test into a tube, series, or chambers separated by narrow openings, serves as an effective barrier to retard effects of unfavorable changes in environmental chemistry; (3) further specialization may adapt test for growth under special physical conditions. The role of the test as a protective device against predators is not understood but may account for some forms. The great variety of test forms suggests that many taxa are adapted for specialized ecologic niches. — VSN

01326 **Martin, B. F.; Manley, F. H.** Clay mineralogy of some Ordovician bentonites from the Chickamauga Supergroup, northwest Georgia [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s22-s23, 1970.

08470 **Martin, Gene B.** The subsurface Frio in South Texas — Stratigraphy and depositional environments as related to the occurrence of hydrocarbons, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 489-501, illus., 1969.

The importance of knowledge of depositional environments in exploration for petroleum in the Frio formation of the Gulf Coastal Plain is illustrated by observations on the depositional history of the subsurface Frio of southern Texas. Environments were identified on the basis of detailed studies of fossils from more than 9,000 samples from about 50 well cores. The biostratigraphy (including chart and log), transgressions and regressions, reservoir rocks and source beds, and depositional habitat of hydrocarbons are discussed. Reservoir rocks are closely related to deltaic environments; most zones are in sands found in regressive depositional cycles. No large scale migration of hydrocarbons can be documented. — VSN

08659 **Martin, Robert F.** The hydrothermal synthesis of low albite: Contr. Mineralogy and Petrology, v. 23, no. 4, p. 323-339, illus., table, 1969.

Glasses on the join $NaAlSi_3O_8$-$Na_2Si_2O_5$ were devitrified hydrothermally at pressures of 1 to 10 kb and temperatures of 200 to 700°C to define more adequately physical and chemical environments favoring crystallization of the fully ordered polymorph of albite. Presence of $Na_2Si_2O_5$ allows synthesis of low albite with an obliquity of 1.140° in runs of relatively short duration. Effect of increasing total pressure and time, and of decreasing temperature and amount of water down to critical values, is to favor synthesis of ordered albite. Excess sodium is the constituent necessary for ordering to proceed at a relatively rapid rate; this rate seems to vary with ratio aNa^+/aH^+, and hence with peralkalinity of the aqueous fluid attending recrystallization, the chemical environment of which is as important as temperature in determining ultimate degree of Si-Al order attained. — *from* Author's abstract

01367 **Martin, W. D.; Henniger, B. R.** Reply [to discussion by J. B. Roen of "Sandstone distribution [in] lower member of the Waynesburg Formation, Green and Washington Counties, southwest Pennsylvania," 1970]: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 3, p. 535, 1970.

The exact position of the boundary of the Mather Sandstone Lentil in the vicinity of Waynesburg, Pa., is open to question and may have to be moved when more information is available. (For original discussion see ibid., p. 532-534) — SEF

08523 **Martinez, Joseph D.** The impact of salt on man's environment, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 49-62, illus., 1969.

The saline environment, an important part of man's ecological system, may be divided into saline waters of oceans and continental salt deposits. Modern technology is developing effective techniques of desalination of oceanic waters; paradoxically, major advances in this field will result in unusable quantities of salt and a major disposal problem. Continental salt accumulations, particularly when associated with oil, gas, and sulfur, have been responsible for development of major chemical complexes which provide raw materials and jobs but create massive pollution problems. Potassium minerals from evaporite deposits serve man as a major source of fertilizer; however, exploitation of these results in accumulation of an unmanageable quantity of salt. Both solution and dry mining of salt can result in land subsidence and create an environmental liability, but, abandoned mines and solution cavities offer a means of disposal of noxious materials. — *from* Author's abstract

Martini, E. *See* Worsley, T. 01365

08804 **Maslov, Yu. S.** Geologicheskoye stroyeniye i genezis rud zolotorudnogo polya Guaymaro (Kuba) [Geology and ore genesis of the Guaymaro gold field (Cuba)]: Sovet. Geologiya 1969, no. 5, p. 129-134, 1969.

The Guaymaro gold field is in a monoclinal area of widely propylitized andesite-basalt porphyrites and tuffs of Lower to Middle Cretaceous age. These effusive rocks are cut by Upper Cretaceous granodiorite intrusions, accompanied by hydrothermal alteration of both effusive and intrusive rocks; both are evidently related to a single deep-seated magma chamber. Fractures, controlling mineralization, were formed in the propylitized rocks. Hydrothermal processes resulted in a superposed gold-sulfide mineralization containing several generations of pyrite and chalcopyrite, native gold, galena, sphalerite, vein quartz, and calcite. The disseminated gold-sulfide mineralizations are steeply-dipped zones containing ribbon- and lense-like ore bodies. Mineralization extends for 300-800 m along the strike and for 150-250 m along the dip. — *from* Author's Russian abstract, EH

08448 **Mason, B. B.** Possible future petroleum provinces in Western Gulf Basin [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 263, 1969.

08733 **Mason, R. S.** Iron, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 143-148, illus., 1969.

Iron resources are contained in a variety of types of deposits in widely scattered areas of the State. The largest and most important are the Scappose limonite deposits. Ferruginous bauxite deposits also represent a significant potential resource. Black sands along the southwestern Oregon coast and near the mouth of the Columbia River have some potential for iron recovery. Because of insufficient exploration, reserves of the Tolman iron deposit in Jackson County cannot be adequately appraised; however, it contains considerable tonnage of fairly high grade ore. — MHM

Mason, R. S. *See* Ramp, Len. 08751

08752 **Mason, R. S.** Soda ash, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 241-246, illus., tables, 1969.

Deposits of soda ash in Oregon have been known for nearly 100 years. Principal deposits are Summer Lake, Lake Abert, and Alkali (playa) Lake, all in Lake County. Recoverable saline solids at Alkali Lake are estimated to be 75,000 to 200,000 tons; however, successful development of Lake County soda ash deposits would require a nearby market outlet. — MHM

08753 **Mason, R. S.** Stone, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 246-268, illus., tables, 1969.

Stone produced is used mainly for construction materials. Commercially significant limestone deposits in Oregon are mostly in southwestern and northeastern Oregon. Occurrences are tabulated. Building stone production dates from the late 1880's, when basalt from St. Helens in Columbia County was quarried and shaped, and now includes granite, sandstone, limestone, marble, and volcanic tuffs and flow rocks. Crushed stone is produced in most communities in the State, and there are large reserves that can be used for crushing and riprap. — MHM

08755 **Mason, R. S.** Coal, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 272-278, illus., 1969.

Important coal fields of Oregon include the Coos Bay, the Eden Ridge, and the Rogue River fields. Small tonnages of coal either have been or could be developed from the Vernonia coals of Columbia County, the Wilhoit area of Clackamas County, the Waldo Hills area of Marion County, the Eckley and Squaw Basin coals of Coos County, and the Shasta Costa coal of Curry County. Other areas contain thin seams of low-grade coal. Coal reserves in the State amount to about 116 million tons. — MHM

08794 **Mason, R. S.** Gem stones, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 210-214, table, 1969.

Seimprecious gems, particularly quartz family minerals, are found in many parts of Oregon. Varieties include agates, jaspers, petrified wood, opal, and thunder eggs. A few small diamonds have been found in gold placer concentrates. Semiprecious gem resources in the State probably are large. - MHM

08795 **Mason, R. S.** Clay, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 200-205, illus., 1969.

Most clay produced in Oregon has been used for common brick and tile. Clay for that use is abundant in northwestern Oregon, particularly in the Willamette and Tualatin Valleys. Refractory clay occurs in several deposits in western Oregon; the most favorable are the Fransen, Ellis, King, and Hobart Butte. Reserves are on the order of 47 million tons, most of which are in the Hobart Butte deposit. Other clayey materials known to occur in the State include bentonite, expansible shale, and high alumina clays. — MHM

Mason, R. S. *See* Clifton, H. E. 08834

08432 **Massad, A. H.** Hydrocarbon exploration and the political-economic environment [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. XV, 1969.

Mathieu, Guy. *See* Li, Yuan-Hui. 08850

Maton, P. I. *See* Horsfield, W. T. 01300

01082 **Matthews, R. David.** The origin of Silurian potash in the Michigan basin [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 393-394, 1970.

May, J. P. *See* Hopkins, E. M. 08468

01083 **Mayer, Victor J.** The undergraduate preparation of earth science teachers at the Ohio State University [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 394, 1970.

08644 **Mayo, Evans B.** Fragmental diapir, Piedmontite Hills, Tucson Mountain Park, Arizona: Arizona Acad. Sci. Jour., v. 5, no. 4, p. 232-239, illus., 1969.

A previously reported "rubble diapir" (Mayo, 1963) is validated by detailed study. Tongue-shaped in surface form and elongated southeastward, it rises only 10 or 15 feet in an area of red siltstone, volcanic conglomerate, breccia and sandstone, intruded by rhyolitic tuff. The red siltstone and detrital volcanic rocks might be Triassic, and an Upper Cretaceous emplacement of the tuff is possible. Petrology and structural profiles are described. Hot emanations from underlying tuffisite are thought to have mobilized a succession of andesitic clastic rocks to intrude and disperse the red siltstone stratum; fragmental andesite then entered and mobilized the overlying conglomerate, causing it to well upward, while marginal portions sank. This diapir may be an example in miniature of a stage in the unroofing of a certain kind of pluton by gas-mobilization. — GDC

McBirney, A. R. *See* Williams, Howel. 08708

McCallum, M. E. *See* Robinson, G. D. 08677

01291 **McCammon, Richard B.** Minimum entropy criterion for analytic rotation: Kansas Geol. Survey Computer Contr. 43, 24 p., illus., tables, 1970.

Minimum entropy is described as an analytic criterion for rotation to simple structure for both principal component and factor analysis data matrices. Minimum entropy

rotated matrices come closer to achieving the ideal simple structure than is possible using the varimax method in the sense that a greater proportion of absolute values of the coefficients in the rotated matrix lie closer to zero. This allows greater ease of recognition of the underlying structure in the original data array. The concept of rotation is extended to include rotation of principal components. Numerical examples [Bahamian sediments, Foraminifera, brine analyses] are given to illustrate the application of minimum entropy rotation in both principal component analysis and factor analysis. — Author's abstract

08814 **McCammon, Richard B.** Multivariate methods in geology, *in* Models of geologic processes, an introduction to mathematical geology — AGI/CEGS short course lecture notes, Philadelphia, 1969: Washington, D. C., Am. Geol. Inst., p. RMA1 — RMF6, illus., tables, 1969.

The brief mathematical background includes a discussion of matrices (sand evolution simulation as example), coordinate geometry, and coordinate and Helmert transformations. The matter of correlation includes correlation between two variables, among k variables, and between two groups of variables. In the classification problem, the number of groups is unknown and has to be determined. In the Bahamian sediments study, each sample is classified as to environmental type depending on which component it most resembles; with this information, facies maps can be prepared and used to interpret patterns of deposition. Graphical correlation is illustrated by dendrograms and dendrographs. In discrimination analysis it is assumed that the populations are known and the task is to set up a rule which will enable one to assign a new member to one of the populations when it is not known from which population the member came. — MCM

01184 **McCloy, James Murl.** Morphologic characteristics of the Blow River delta, Yukon Territory, Canada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3234B-3235B, 1970.

McClurg, James E. *See* Smith, Charles I. 01104

01238 **McComas, Murray Ratcliffe.** Pleistocene geology and hydrogeology of the middle Illinois Valley [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3709B, 1970.

McDowell, L. L. *See* Grissinger, E. H. 01375

01084 **McGinnis, L. D.; Sowayan, A. R.; Jensen, T. E.** Geophysical studies of the ancient Mississippi River bedrock valley [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 394-395, 1970.

08815 **McIntyre, Donald B.** Introduction to the study of data matrices, *in* Models of geologic processes, an introduction to mathematical geology — AGI/CEGS short course lecture notes, Philadelphia, 1969: Washington, D. C., Am. Geol. Inst., p. DBM-A1 — DBM-A44, illus., tables, 1969.

A matrix is a rectangular ordered array of elements which behave according to certain sets of axioms. The example given is that of a simple matrix representing pure plagioclase feldspars, with variables O, Na, Al, Si, and Ca being the major constituents in order of increasing atomic number; a detailed mathematical explanation follows. Fictitious data are used to illustrate an example of cluster data which is used for the resolution of many groups; this requires analysis of the matrix of interpoint distances which are invariant with respect to choice of axes and viewpoint only if the same scale is used in all dimensions. — MCM

08816 **McIntyre, Donald B.** Selected bibliography, *in* Models of geologic processes, an introduction to mathematical geology — AGI/CEGS short course lecture notes, Philadelphia, 1969: Washington, D. C., Am. Geol. Inst., p. DBM-C1 — DBM-C4, 1969.

08835 **McIntyre, Donald B.** Supplementary notes on APL/360, *in* Models of geologic processes, an introduction to mathematical geology — AGI/CEGS short course lecture notes, Philadelphia, 1969: Washington, D. C., Am. Geol. Inst., p. DBM-B1 — DBM-B23, 1969.

APL/360 is a powerful language for conversational communication with large computer systems through remote terminals; it is adapted equally to microprogramming and hardware description, to file manipulation and text aditing, to computer assisted instruction, and to matrix algebra. The example is not an APL manual, but only classroom notes for one short session using the program. — MCM

08789 **McKay, E. J.; Alvord, D. C.** Geologic map of the Lick Creek quadrangle, Pike County, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-716, scale 1:24,000, text, 1969.

Mineral resources developed in the Lick Creek quadrangle are natural gas mainly from the Devonian Ohio Shale and Mississippian Greenbrier Limestone, and coal largely from the Lower Elkhorn coal bed, but recently also from the Clintwood bed and beds of the Fire Clay-Whitesburg zone. Locally coal beds are as much as 8 feet thick; those less than 26 in. thick are seldom mined. Undeveloped resources include sand and gravel from alluvial deposits, and sandstone and shale in the Breathitt Formation. — MCM

01352 **McKenzie, G. D.** Rate of collapse of snow-bank kames in Adams Inlet, southeastern Alaska: Ohio Jour. Sci., v. 70, no. 2, p. 107-111, illus., table, 1970.

Mounds formed by the differential ablation of snow covered by varied thicknesses of sand that has slumped onto a snow bank from an adjacent bluff are here named snow-bank kames. The rate of collapse of these mounds, calculated from temperature observations in the sand and using the temperature gradient method, was 2.2 cm day^{-1}. The observed rate of lowering for these mounds was between 2.6 and 3.2 cm day^{-1}. The difference in rates may be due to mechanisms of heat transfer other than conduction. — Author's abstract

01239 **McKinney, Thomas Francis.** Continental shelf sediments off Long Island, New York [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3709B-3710B, 1970.

08770 **McLerran, James H.** Remote sensing and interpretation of sea-ice features, [Chap.] 11 *in* Oceans from space (P. C. Badgley, L. Milroy, and L. Childs, editors) — Symposium, Houston, Tex., Proc.: Houston, Tex, Gulf Publishing Co., p. 159-170, illus., 1969.

Several remote sensors found useful for sea ice each have advantages and disadvantages as shown in imagery samples. Aerial photography, most informative on surface features per unit area, is limited to daylight and good weather. Infrared imagery shows geometric patterns and apparent surface temperature as phototones, closely related to ice thickness; the all-year infrared sensor can be used during arctic winter darkness but not in bad weather. In radar imagery winter ice can be differentiated from polar ice; concentration and distribution of ice can be mapped and size of floes determined. The radar and the passive microwave sensors have all-weather capabilities but are limited in resolution. By the high apparent temperature differences between ice and water, icebergs can be detected and sea-ice boundaries delineated. On a larger scale, daily coverage of satellite photography will be a great benefit to polar oceanographers. — GDC

01299 **McMorris, Daniel W.** ESR detection of fossil alpha damage in quartz: Nature, v. 226, no. 5241, p. 146-148, illus., 1970.

During thermoluminescence dating using electron spin resonance (ESR) detection in quartz, a natural signal was detected which was not regenerated by Co-60 gamma ray doses as high as 10^7 r after annealing at 500°C. Accumulated lattice damage caused by traces of uranium and thorium seems to be responsible. This damage signal may

permit ESR dating (using a pile calibration dose) and geologic thermometry of quartz extracts and certain natural glasses. Its strength is proportional to the number of damaged regions (if they do not overlap). A comparison of its natural and artificially induced intensities could offer special advantages over fission track counting in the case of finely divided material such as lunar dust. — DBV

McMurdie, Howard F. *See* Levin, Ernest M. 08704

08433 **McNamee, Donald F.** The Glen Rose reef complex of East Texas and central Louisiana, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 11-21, illus., 1969.

The massive limestone sections of the Glen Rose of East Texas and central Louisiana are considered to be clastic carbonate barrier reefs. The cause, sequence and depositional form of a clastic barrier reef complex is presented in theory and supported by examples. Basinal subsidence, a regressive pattern of deposition and subsequent fore reef leveling during periods when the sea was restricted in front of the barrier reefs develop a typical depositional form. At least three separate clastic barrier reef complexes have developed in the lower Cretaceous of Sabine County, Texas and Sabine Parish, Louisiana. Post lower Cretaceous regional tilting has altered original reservoir conditions but there remains great potential for hydrocarbon accumulations in stratigraphically controlled traps. — Author's abstract

08608 **Mehringer, Peter J., Jr.; Ferguson, Charles W.** Pluvial occurrence of bristlecone pine (*Pinus aristata*) in a Mohave Desert mountain range: Arizona Acad. Sci. Jour., v. 5, no. 4, p. 284-292, illus., 1969.

For evidence of pluvial expansion of montane forests, ancient woodrat middens were investigated from a rock shelter 1910 meters up on the south side of isolated Clark Mtn., Calif., southwest of Las Vegas, Nev. Two middens with bristlecone and limber pine gave C-14 dates of 23,600±950 and 28,720±1800 years B.P.; a third with Utah juniper, and single-leaf pinyon dated at 12,460±190 B.P., had no bristlecone pine. These species are at considerably lower elevation than present rat zones on nearby Spring Mts., Nev. Extant white fir, oldest known in the Great Basin and Rocky Mountain portion of its range, is protected below the north face of Clark Mtn.; a 500-m elevation depression is needed to explain its presence in the midden site. Growth characteristics of the dated pinyon could not be duplicated in 26 extant samples from both mountains. Thus, conditions in the midden area on Clark Mtn. 12,500 yr ago were more moist than today. — GDC

08624 **Mejía Dautt, O.** Características geológicas generales de la zona de Poza Rica [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 83, 1969.

Melson, William G. *See* MacDonald, William D. 08818

01085 **Melton, William; Scott, Harold W.** Progress report on the study of the conodont-bearing animal [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 395, 1970.

Merrill, G. F. *See* Weeks, L. A. 08530

01086 **Merrill, Glen K.** Environmental and other non-biostratigraphic controls of Pennsylvanian conodont faunas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 395-396, 1970.

08591 **Merrill, Robert K.** The glacial geology of the White Mountains, Apache County, Arizona [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 36, 1969.

01087 **Meyerhoff, Howard A.** Basement relief beneath the Upper Cambrian of the mid-continent [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 396, 1970.

Mielke, James E. *See* Stuckenrath, Robert, Jr. 01338

Miers, John H. *See* Campbell, K. Vincent. 01190

01088 **Miller, Barry B.; Wittine, Arthur H.** Depositional environment of late Pleistocene deposits at Garfield Heights (Cleveland), Ohio [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 396-397, 1970.

01372 **Miller, Barry B.** The Sandahl molluscan fauna (Illinoian) from McPherson County, Kansas: Ohio Jour. Sci., v. 70, no. 1, p. 39-50, illus., tables, 1970.

Sixty-three molluscan species in sediments deposited by ancestral Smoky Hill River are described, four not previously reported from the state. The relative diversity of the unionid species and the abundance of *Probythinella lacustris* imply the former existence of a river much larger than the present Smoky Hill. The paucity of woodland forms and abundance of forms of dry, open conditions suggest only scattered stands of trees bordered the river. The present distribution of extant unionid species from this fauna suggests that at the time of deposition, the Smoky Hill may have been a tributary of Arkansas River via the Cottonwood-Neosho system. The climate combined average summers of 65° to 70°F, cooler than now, and average winter temperatures between 30° and 35°F. Precipitation was not necessarily different from now. — *from* Author's abstract

08661 **Miller, Donald G., Jr.; Richards, Adrian F.** Consolidation and sedimentation-compression studies of a calcareous core, Exuma Sound, Bahamas, *in* Lithification of carbonate sediments, [Pt.] 2; Sedimentology, v. 12, nos. 3-4, p. 301-316, illus., 1969.

Grain size, bulk density, Atterberg limits, water content, vane shear strength, pore-water salinity, and carbonate content of a core are compared with similarly derived values from laboratory experiments, and are related to depth in the core. Laboratory measurements differ markedly from in-place relations between void ratio, or water content, and the effective overburden pressure, or burial depth. The previous maximum-consolidation pressure, based on laboratory data, is about 60 times greater than the computed in-place effective overburden pressure. An explanation includes time for consolidation, cementation occurring in-place, and orientation of the constituents. It is suggested that results of the consolidation test on carbonate muds or oozes should be interpreted with caution for geological and engineering purposes. — *from* Authors' summary

Miller, James F. *See* Barnes, Christopher R. 01049

01089 **Miller, James F.** The Cambro-Ordovician boundary of the U.S. — A diachronous horizon [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 397, 1970.

01090 **Miller, Roy M.** Blue glass from Craters of the Moon National Monument, Idaho [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 397, 1970.

Milliman, J. D. *See* Stetson, T. R. 08441

08445 **Milliman, John D.** Carbonate sedimentation on four southwestern Caribbean atolls and its relation to the "oolite problem," *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 195-206, illus., tables, 1969.

Courtown and Albuquerque Cays and Roncador Bank are small atolls in the southwestern Caribbean, encompassing areas of 22 to 29 km². Shallow open lagoons contain sediments rich in *Halimeda*, coral, and coralline algae debris, derived from peripheral reef flats and lagoonal patch reefs. Oolite and other nonskeletal carbonates are present only in small amounts. Serrana Bank is almost an order of magnitude larger (191 km²) than the other three atolls, but has roughly similar morphologic and hydrographic environments. Because of their small area, peripheral reefs at Serrana Bank do not contribute a significant amount of sediment to the lagoon. Eastern lagoon sediments are from nearby patch reefs, but in the western where hermatypic growth is limited, dominant sediments are nonskeletal oolite, crypto-crystalline lumps and pelletoids. Formation of nonskeletal carbonates in open lagoon conditions at Serrana may be related to lack of biogenic carbonate sedimentation. — *from* Author's abstract

Milloy, Leatha. *See* Badgley, Peter C. 08691

01185 **Misra, A.; Faure, G.** Restudy of the age of the Gunflint Formation of Ontario, Canada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 398, 1970.

Modzeleski, Vincent E. *See* Scott, Ward M. 01364

01298 **Molnar, Peter; Savino, John; Sykes, Lynn R.; Liebermann, Robert C.; Hade, George; Pomeroy, Paul W.** Reply to Thirlaway [comment on Molnar et al, "Earthquakes and explosions" (1969)]: Nature, v. 225, no. 5239, p. 1238, 1970.

The earlier report mentioned by Thirlaway in his comments (ibid., p. 1237-1238) did suggest spectral differences for explosions and earthquakes but from his data it is not possible to attribute these differences unambiguously to the two kinds of sources because earthquake and explosion data were not shown for the same region. The data presented by Molnar and others (ibid., v. 224, no. 5226, p. 1268-1273, 1969; Abstracts of North American Geology, May 1970) were obtained for nearly identical source regions and propagation paths, and extended to periods of about 50 sec. Thirlaway's assessment of the detection threshold probably is a pessimistic interpretation of Molnar and others' results. A comparison of 50-sec Rayleigh waves with m_b seems to be the best discriminant for underground explosions and earthquakes. — DBV

Monroe, Eugene A. *See* Barnes, Christopher R. 01050

08500 **Montoya, J.** Bismuthian bindheimite, Mammoth Mine, Eureka, Utah: Am. Mineralogist, v. 54, nos. 11-12, p. 1726-1728, table, 1969.

A variety of bindheimite (hydrous antimonate of lead) containing 6.8 percent Bi_2O_3 and 0.8 percent Ag_2O was identified in an oxide zone of the Mammoth Mine, Eureka, Utah. The chemical analysis of bismuthian bindheimite shows a low antimony content, presumably due to the substitution of bismuth for antimony in the lattice structure. Optically, the mineral grains are heterogeneous, showing a range in index of refraction, color, and clarity. X-ray diffraction shows the presence of a single mineral phase with a pyrochlore-type structure. — Author's abstract

Moore, Carleton B. *See* Lewis, Charles F. 08588

Moore, Carleton B. *See* Lewis, Charles F. 08589

08476 **Moore, Clyde H., Jr.** Factors controlling carbonate sand distribution in the shallow shelf environment, illustrated by the Texas Cretaceous [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 507, 1969.

08669 **Moore, David G.** Reflection profiling studies of the California Continental Borderland — Structural and Quaternary turbidite basins: Geol. Soc. America Spec. Paper 107, 142 p., illus., tables [1969].

The Continental Borderland Province, off southern California and northern Baja California, is bounded by the Transverse Range, Peninsular Ranges, and submarine Baja California Seamount Provinces. A map of litho-orogenic units amplifies structural data in showing a large preorogenic sedimentary basin, largely Miocene, flanked by highs of volcanic and basement rocks. Deposition in an open continental terrace or simple basin is suggested rather than isolated block-faulted basins. Regional stress causing Miocene tectonics is laid to sea-floor spreading, with drag of marginal crust, originating from within the Gulf of California. Its reactivation formed a postorogenic basin and feeder canyons in the inner borderland. Volumetric distribution, internal structure, time and rate of deposition indicate that turbidity currents were paramount in masking hemipelagic deposition. A system of transportation-deposition processes for such turbidite basins is proposed. — GDC

08466 **Moore, Donald R.** Systematics, distribution, and abundance of the West Indian micromollusk *Rissoina catesbyana* d'Orbigny, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 425-426, 1969.

It is shown that *Rissoina catesbyana*, the common West Indian micromollusk, is an indicator of inshore slightly brackish waters. It is not found in the coral reef tract and

cannot penetrate far into waters of low salinity. Its abundance makes it applicable as an environmental indicator, and where present in the fossil record should be a clue to the paleoenvironment. — VSN

01182 **Moore, James G.** Pillow lava in a historic lava flow from Hualalai Volcano, Hawaii: Jour. Geology, v. 78, no. 2, p. 239-243, illus., 1970.

Scuba exploration of the seaward extension of the 1801 Huehue lava flow produced photographs and samples of pillowed lava 1/4 mile offshore. Since emplacement of the flow the glassy rind of the pillows has been altered to palagonite to a depth of 20-30 microns. — REW

01286 **Moore, Paul B.** A crystal-chemical basis for short transition series orthophosphate and orthoarsenate parageneses: Neues Jahrb. Mineralogie Monatsh. 1970, no. 1, p. 39-44, illus., table, 1970.

In the basic phosphates and arsenates of iron and manganese, increasing temperature results in increasing octahedral clustering, with higher M:O ratios appearing. This trend is observed paragenetically. It is suggested that the entire crystal-chemical family of Fe-Mn phosphates and arsenates be classified on the basis of the M:O ratios determined from crystal structure analysis. — DBV

08637 **Morales Reyna, M.** Consideraciones gravimétricas de la región occidental de la Plataforma de Yucatán [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 88, 1969.

01091 **Moran, Stephen R.; Deal, Dwight E.** Glacial Lake Souris — A study in the complexity of a glacial-lacustrine environment [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 398, 1970.

01204 **Morency, Maurice; Emond, Pierre L.; vonBitter, Peter H.** Dating conodonts using electron spin resonance — A possible technique, *in* Short papers in research in 1969: Kansas Geol. Survey Bull. 199, pt. 1, p. 17-19, illus., 1970.

Electron spin resonance is a means of detecting, with microwaves, the presence of electrons trapped in the structure of crystalline material. Prior to being trapped, the electrons are released from their parent atoms by radiation from radioisotopes present in the conodonts and the host rock. The feasibility of using electron spin resonance as a dating technique was tested on conodonts (fossil toothlike structures) from the Holts Summit Formation (Upper Devonian), Missouri, the Bushberg Formation (Upper Devonian to Lower Mississippian), Missouri, and the Heebner Shale Member of the Oread Limestone (Upper Pennsylvanian). All of the conodonts yielded an electron spin resonance spectrum arising principally from trapped electrons. It was found that this spectrum would be suitable for the age determination calculations described herein. — Authors' abstract

01092 **Mosher, L. Cameron.** Evolutionary, ecologic, and geographic observations on conodonts during their decline and extinction [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 398-399, 1970.

01216 **Moussa, Mounir T.** Nematode fossil trails from the Green River Formation (Eocene) in the Uinta Basin, Utah: Jour. Paleontology, v. 44, no. 2, p. 304-307, illus., 1970.

Wavelike trails occur in large numbers at two stratigraphic horizons in the Green River Formation (middle Eocene) in the western Uinta Basin, Utah. One horizon is in the lower part of the delta facies in the Soldier Summit area and the other in the upper Parachute Creek Member or the lower Evacuation Creek Member in upper Timber Creek in Wasatch County, Utah. The fossil trails are interpreted as nematode trails because nematodes are the only recent organisms known to make sinusoidal trails of the same size and form. If the interpretation is correct, these occurrences represent an interesting and a most unusual record of an entire animal phylum which is virtually unknown in the fossil record. — *from* Author's abstract

Muller, P. M. *See* Burke, J. D. 01296

01210 **Murphy, James L.** Coiled nautiloid cephalopods from the Brush Creek Limestone (Conemaugh) of eastern Ohio and western Pennsylvania: Jour. Paleontology, v. 44, no. 2, p. 195-205, illus., 1970.

Six species (2 new) of nautiloid cephalopods from limestones in the Allegheny Conemaugh Groups in Ohio and Pennsylvania are described and illustrated. Of more than 200 specimens, the bulk came from a thanatocoenose in the Brush Creek Limestone Member of the Conemaugh at one locality in Columbiana County, Ohio, which yielded 156 specimens of *Metacoceras mcchesneyi*, n. sp., 37 of *Domatoceras gardi*, n. sp., and a few specimens of two others. — JWH

Murray, James W. *See* Garrison, Robert E. 08695

01253 **Myrick, R. M.** Ground water, *in* Objectives, methods, and environment — Gila River Phreatophyte Project, Graham County, Arizona: U.S. Geol. Survey Prof. Paper 655-A, p. A16-A17, illus., 1970.

Water in the basin fill of the Gila River valley is under artesian pressure. Terrace and floodplain alluvium that rests upon the fill and in channels constitutes the major aquifer; its permeability is high but variable. Water storage changes seasonally, its movement influenced by growth of phreatophytes. Measurement of changes in water level in stock wells gives an indication of changes in rate of inflow from the basin fill. A network of additional observation wells, established to measure inflow and outflow in the project area and to define movement of the ground water, was drilled in lines across the main channel at about 1-mile intervals. In the summer of 1964, the water table declined far below any previously measured level, and it was necessary to deepen some wells. Digital recorders code water level at 30-minute intervals. — GDC

Nagy, Bartholomew. *See* Scott, Ward M. 01364

01258 **Naidu, Prabhakar S.** Statistical structure of aeromagnetic field: Geophysics, v. 35, no. 2, p. 279-292, illus., 1970.

A study of the statistical structure of an aeromagnetic field over approximately four and a half thousand square miles of the Perry Sound and Huntsville area of southern Ontario has revealed the following: From the point of first-order statistics, that is, mean, variance, skewness, and probability distribution function, the right half of the area which is occupied by hornblende or biotite migmatite is homogeneous and Gaussian, whereas the left half, which is mainly occupied by amphibolite gneiss, is generally inhomogeneous and non-Gaussian. From the point of view of second-order statistics, that is, the spectrum, the entire field appears to be inhomogeneous. This difference between statistical pictures is attributed to the fact that there are at least two preferred directions of strike, which influence the shape of the spectrum significantly. — Author's abstract

01220 **Nassichuk, W. W.; Furnish, W. M.** *Christioceras*, an arctic Pennsylvanian ammonoid, discovered in west Texas: Jour. Paleontology, v. 44, no. 2, p. 399-401, illus., 1970.

Christioceras, a schistoceratid known previously only from Atokan strata near the base of Hare Fiord Formation in northern Ellesmere Island is reported from the "Smithwick Shale horizon" of the Magdalena Formation, Culberson County, Texas. — *from* Authors' abstract

01240 **Nathan, Harold Decantillon.** The geology of a portion of the Duluth complex, Cook County [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3710B-3711B, 1970.

08639 **Navarro Galindo, A.** Problemas de exploración para las zonas posiblemente petrolíferas, area Chihuahua [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 89-90, 1969.

01275 **Neff, Thomas Rodney.** Petrology and structure of the Buffalo Mountain pluton, Humboldt County, Nevada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3711B, 1970.

08686 **Nelson, Dennis O.; Shearer, Gerald B.** The geology of Cedar Butte, northern Coast Range of Oregon: Ore Bin, v. 31, no. 6, p. 113-130, illus., tables, geol. map, 1969.

Cedar Butte consists of basalt flows, basaltic pillow lavas, and submarine breccias, unconformably overlying sparsely fossiliferous tuffaceous shales and volcanic sandstones. Leaf fossils in sedimentary rocks indicate a temperate climate and shallow-water environment. The sedimentary rocks appear to be derived from volcanic rocks. Later volcanism is indicated by basalt flows, flow breccias, and a crystal-vitric tuff. Pillow lavas, pillow palagonite breccias, palagonite breccias, and submarine breccias indicate the volcanism was dominated by submarine activity. It is probable that the sedimentary sequence is part of the middle to late Eocene Tillamook Volcanic Series. The presence of an angular unconformity between the Eocene sedimentary sequence and the younger volcanic sequence, and the possible tholeiitic character of the younger basalts suggest that they may be related to the Miocene Columbia River Basalt. — *from* Authors' summary

08801 **Nelson, Willis H.; Ross, Clyde P.** Geologic map of the Mackay quadrangle, south-central Idaho: U.S. Geol. Survey Misc. Geol. Inv. Map I-580, scale 1:125,000, 1969.

01192 **Newcomb, R. C.; Repenning, C. A.** Occurrence of mammoth fossils in the Touchet Beds, south-central Washington: Northwest Sci., v. 44, no. 1, p. 16-18, illus., 1970.

Fragments of mammoth bones were found at an eroded edge of the Horse Heaven Plateau where the Quaternary Touchet Beds are entrenched by a dry wash. — ESL

08719 **Newcomb, R. C.** Geology of the Deschutes-Umatilla Plateau, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 60-66, illus., 1969.

The Deschutes-Umatilla Plateau includes a 100-mile-long strip of east sloping piedmont along the base of the Cascade Range and a main part that descends northward from Central Oregon to the Columbia, Umatilla, and Walla Walla Rivers. Pre-Tertiary schists and gneisses and intrusive diorite and norite are exposed on the north slopes of the Blue Mountains. Up to 3,000 feet of Columbia River basalt constitutes the major rock unit of this area. In places the basalt is overlain by sedimentary rocks: Pliocene tuffs and sandstones; sands and gravels of Pleistocene glaciofluvial deposits; and Pleistocene and Holocene alluvium and loess. Mineral resources are limited except for road metal and semiprecious agate, chalcedony, and common opal. — MHM

08720 **Newcomb, R. C.** Geology of the Joseph Upland, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 66-68, 1969.

The Joseph Upland comprises plateau and canyon lands bordered on the south by the Wallowa River, on the east by the Snake and Imnaha Rivers, and on the west by the Grande Ronde River. From 1000 to 3000 feet of accordantly layered Miocene and lower Pliocene Columbia River basalt underlies most of this area. Mineral resources include peat, common stone, road metal, siliceous deposits — agate, chalcedony, and common opal — and small amounts of interbedded tuff and volcanic ash. — MHM

08749 **Newton, V. C., Jr.** Saline water, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 231-232, illus., table, 1969.

Saline waters occur in sedimentary, metamorphic, and volcanic rocks of all ages. Connate marine and volcanic waters are the two main types of saline water in Oregon. During the 1920's attempts to recover salt from lakes and springs near Alkali Lake, Lake County, proved uneconomic. Prior to 1869 springs in the Umpqua Valley in Douglas County produced up to 1000 pounds of salt per day. Analyses of saline waters in Oregon are given in tabular form. — MHM

08756 **Newton, V. C., Jr.** Oil shale, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 278-280, table, 1969.

The only oil shale deposit known in Oregon is the Shale City deposit in Jackson County. Tests of this shale, which is estimated to contain 150,000 tons of shale, indicate a yield of 36 gallons per ton. The prospect of finding significant oil shale deposits in the State appears remote. — MHM

Newton, V. C., Jr. *See* Wagner, H. C. 08757

Nichols, Bruce M. *See* Campbell, K. Vincent. 01190

08465 **Nicol, David.** Deposit-feeding pelecypods in recent marine faunas, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 423-424, table, 1969.

All epifaunal and most infaunal pelecypods are suspension feeders; but all protobranchs, including the solemyids, and almost all tellinids and semelids are deposit feeders. The protobranchs are the most diverse in cold and temperate water, and the tellinids and semelids are the more diverse in warm water. The 20°C isotherm divides those pelecypod faunas dominated by protobranchs from those dominated by tellinids and semelids. The abyssal fauna has a larger percentage of deposit feeders than any shallow-water fauna because of the greater diversity of protobranchs. The Antarctic fauna is the only one devoid of tellinaceans. — Author's abstract

Nigrini, C. *See* Peterson, M. N. A. 01371

Nigrini, Catherine. *See* Cita, Maria B. 01359

Noel, J. A. *See* Bradshaw, L. E. 01056

Noguchi, Kimio. *See* Araki, Tadashi. 08839

01116 **Noland, Anne Vinson.** Revisions of selected Silurian arenaceous foraminifera from north-central Kentucky and southeastern Indiana [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3310B, 1970.

01133 **Norford, B. S.** Ordovician and Silurian biostratigraphy of the Sogepet-Aquitaine Kaskattama Province No. 1 well, northern Manitoba: Canada Geol. Survey Ppaer 69-8, 36 p., illus., tables, 1970.

Nine faunal assemblages and a barren interval can be recognized in the Ordovician and Silurian successions penetrated by a deep well in northern Manitoba. The nine assemblages span the interval from late Caradoc to late Llandovery or early Wenlock time but a hiatus is probably present between the Ordovician and Silurian, corresponding to an unconformity beneath the Severn River Formation in the Hudson Bay Lowlands. — Author's abstract

01200 **Norgren, J. A.; Borchardt, G. A.; Harward, M. E.** Mt. St. Helens Y ash in northeastern Oregon and south-central Washington [abs.]: Northwest Sci., v. 44, no. 1, p. 66, 1970.

Norris, Robert M. *See* Webb, Robert W. 08711

Norton, L. J. *See* Zemanek, Joe. 01257

01093 **Norton, Norman J.; Allen, David.** Analyses of palynomorph assemblages from mid-continent and eastern Devonian formations [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 399-400, 1970.

Nosov, G. L. *See* Rateev, M. A. 08692

01337 **Nydal, Reider; Lövseth, Knut; Syrstad, Oddveig.** Trondheim natural radiocarbon measurements V: Radiocarbon, v. 12, no. 1, p. 205-237, 1970.

The present date list covers mainly the datings done from 1964 to 1968 on geologic samples from Norway, Sweden, Finland and Newfoundland (Canada); and archeologic samples from Newfoundland, Marquesas Islands, and Norway. — MCM

08513 **O'Dette, Ralph E.; Dickman, John T.** Earth science information in a computer-based chemical information system, *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 331-346, illus., 1969.

Chemical Abstracts Service (CAS) is in the process of evolving a computer-based information system to process all material selected for abstracting in the area of chemistry and chemical engineering and its related fields such as the earth sciences and technologies; this system is already operational to some extent and is expected to be fully utilized by 1971. *Chemical Abstracts* handle some 5,000 abstracts weekly from 13,000 journals and patents from 25 nations; these cover 80 *CA* subject sections in chemistry and also extend into areas of interest to geologists, mineralogists, and mining engineers. The concept of a computer-based information system is that of a single machine-language data base into which results of intellectual analysis of literature are entered and from which computer programs produce a variety of publications and services. — *from* Authors' abstract

01094 **Odom, I. Edgar.** Mineralogy of the Franconia and adjacent formations in western Wisconsin and eastern Minnesota — A progress report [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 400, 1970.

Odom, I. Edgar. *See* Peters, Walter G. 01096

Oglesby, Woodson R. *See* Ball, Mahlon M. 08453

Oliphant, Jerrelyn. *See* Campbell, K. Vincent. 01190

Oliver, Howard W. *See* Barnes, David F. 08570

08575 **Oliver, Howard W.** The U.S. Geological Survey's gravity program in California, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 543-545, 1969.

Since 1963 the U.S.G.S. has entered into a cooperative program for completing a 5-mgal Bouguer gravity map of California at a scale of 1:250,000 by 1970. The areal division of responsibility is shown on a sketch map. About 9,000 new stations were occupied by the U.S.G.S. in 1968 and 1969. Gravity meters, datum, and reduction of data are discussed. The large-scale objectives of the program are to test isostasy in the Sierra Nevada, to determine structure of the Sierra Nevada batholith and its relation to other Mesozoic plutonic rocks, to determine the subsurface expression of the San Andreas fault, and to study possible landward extension of the gravity lineament recently found by Dehlinger and others [1967] over the Mendocino escarpment off northern California. — GV

Oliver, Jack. *See* Sykes, Lynn R. 08780

Oliver, Jack E. *See* Alsop, L. E. 08788

01270 **Olson, Everett C.** *Trematops stonei* sp. nov. (Temnospondyli: Amphibia) from the Washington Formation, Dunkard Group, Ohio: Kirtlandia, no. 8, 12 p., illus., 1970.

Trematops stonei, a new species of this genus of temnospondylous, labyrinthodont Permian amphibian, is described and figured. The specimen upon which the description is based was found in the Creston Shale, Dunkard Group, Lower Permian, at Marietta, Ohio. This genus, along with *Melanothyris* (previously known from the Dunkard), and *Dimetrodon* and *Diadectes*, recently obtained from a channel-fill deposit at Belpre, Ohio, indicate the presence of a terrestrial component in the Early Permian faunas of this region. This part of the faunal complex is rarely represented in the usual pond-lake deposits of the Dunkard Group. — Author's abstract

08623 **Oñate Espinosa, R.** Estudio de las velocidades de propagación de las ondas sísmicas en el área Ahuatepec-Aragón, Ver. [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 82, 1969.

08680 **Oñate Espinosa, R.** Problemas geofísicos de Yucatan [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 89, 1969.

01362 **Ondrick, C. W.; Srivastava, G. S.** CORFAN-FORTRAN IV computer program for correlation, factor analysis (R- and Q-mode) and varimax rotation: Kansas Geol. Survey Computer Contr. 42, 92 p., illus., tables, 1970.

CORFAN, a composite of four computer programs, provides for computation of correlation coefficients (<100 variables), factor analysis (maximum 100, of which 60 may be rotated), and analysis of an unlimited number of samples. Of 86 chemical analyses of tholeiitic and alkali basalt Hawaiian rocks selected at random from over 200 analyses, a tentative classification as either alkali or tholeiitic basalts was obtained. Based on simultaneous evaluation of 11 analyzed chemical oxides, a continuous series of samples is discernible. Based on the statistical procedure, the classification differed from another investigation, especially for those rocks classed as alkali basalt. The analysis is not intended to prove that a complete gradation from alkali basalts to tholeiitic basalts exists, but rather to illustrate the potential value of the technique in classifying all types of rocks. — MCM

08663 **O'Neill, Bernard J.; Kunasz, Ihor A.; Wright, Lauren A.** The lithium production curve — A measure of many things: Earth and Mineral Sci., v. 38, no. 6, p. 45-48, illus., 1969.

The prime sources of lithium prior to the late 1930's were pegmatite bodies. Of the 145 minerals containing lithium as a major constituent, only spodumene, lepidolite, amblygonite, petalite, and eucryptite have been commercial sources. Lithium-bearing pegmatite bodies display orderly internal structure featured by zones of contrasting mineralogy and/or texture. In 1938, a plant at Searles Lake, Calif., began to produce dilithium sodium phosphate at one step in the main cycle of brine treatment. Unzoned bodies of spodumene-bearing pegmatite distributed along a narrow belt from Gaffney, S. C., to Lincolnton, N. C., proved to contain the world's largest reserve of spodumene. The largest concentration, at Kings Mtn., N. C., is being mined. A promising brine was discovered in a dry lake in Clayton Valley, near Silver Peak, Nev.; the lake beds consist of detritus derived from the ranges, and source of lithium may be nearby hot springs. — ESL

Onuki, H. *See* Seki, Y. 08714

08544 **Opdyke, N. D.; Phillips, J. D.** Paleomagnetic stratigraphy of Sites 1-7 (Leg 1) — Preliminary report, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 501-517, illus., table [1969,].

Preliminary analyses of specimens provided by the shipboard sampling program show that: (1) Much of the core material is potentially useful for paleomagnetic purposes; the drill coring and specimen preparation techniques proposed by Opdyke and Phillips appear to be satisfactory. (2) Wide dispersion of the remanent magnetic vector directions accompanied by inadequate density of sampling at all sites does not allow direct application of the paleomagnetic reversal dating techniques or studies of ancient geomagnetic field behavior. More detailed laboratory sampling and demagnetization analysis will be required. — Authors' conclusions

08626 **Ordelas, F.** Posibilidades petrolíferas de los sedimentos subyacentes al Caloviano en sedimentos de facies lagunales (Huehuetepec) [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 83, 1969.

Oregon Dept. Geology, Min. Industries. *See* U.S. Geological Survey. 08715

Oriel, Steven S. *See* Mabey, Don R. 01163

01191 **Orr, William N.; Zaitzeff, James B.** Miocene Silicoflagellates from southeast Oregon: Northwest Sci., v. 44, no. 1, p. 12-15, illus., 1970.

Silicoflagellates of the Bandon diatomite show the highest degree of similarity to the fauna of the Delmontian Buttle diatomite in California. Three forms co-occur in both units in similar frequencies. The presence of the Delmontian species *Distephanus ornamentus* (Ehrenberg) in the Bandon diatomite corroborates the late Miocene age earlier indicated by diatoms. — Authors' conclusions

Otsuka, Ryohei. *See* Hayashi, Hisato. 08493

08473 **Otvos, Ervin G., Jr.** The Moreau-Caminada chenier complex, southeastern Louisiana [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 505, 1969.

01174 **Outerbridge, W. F.** Sedimentary environments of the Magoffin Beds of Morse in eastern Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 235, 1970.

01273 **Overton, Harold L.** Rock stress and casing collapse: Log Analyst, v. 11, no. 1, p. 17-22, illus., 1970.

The salinity principle has been tested in areas where tectonic stresses have been proven to be active; these cases include geologic areas with regional faulting, near-horizontal thrust faulting, and heaving shales. Large salinity contrasts within a few hundred, vertically, are observed whenever there is thrust faulting, heaving shales, or casing collapse. Casing buckling was predicted from stress calculations in one case, simultaneous with its occurrence. Salinity profiles are excellent indicators of stress in marine sands whenever the sand-shale ratio is less than 1; an equation given here applies well in these cases. Whenever the shale fraction is small, diffusion masks the effect of compaction; in these cases salinity may decrease with depth, requiring use of the density log to solve compaction coefficients. — *from* Author's abstract

08671 **Owen, David E.** Wenlockian Bryozoa from Dudley, Niagara, and Gotland and their palaeogeographic implications: Palaeontology, v. 12, pt. 4, p. 621-636, illus., 1969.

A comparison is made between the Wenlockian bryozoan faunas of Dudley [England] and those of the Niagaran region of New York State, and localities near Visby, in Gotland [Sweden]. Their occurrence fits a narrow Atlantic, the Niagaran and Dudley faunas occupying a different climatic zone from that of Gotland. The following new species are described from the British material: *Meekopora dudleyensis*, *Stenopora primaeva*, and *Batostomella maniformis*. The new genus *Asperopora* is proposed for Silurian and lowermost Devonian species of *Leioclema* with numerous, often cystose mesopores, and acanthopores which frequently inflect zooecial apertures. — Author's abstract

08827 **Owens, James P.** Coastal Plain rocks of Harford County, *in* The geology of Harford County, Maryland: Baltimore, Md., Maryland Geol. Survey, p. 77-103, 123-127, illus., tables, geol. maps, 1969.

In the southern third of the county deeply dissected Coastal Plain sediments thickening southeastward crop out at elevations between 400 feet and sea level. Distribution, thickness, and lithology of units are described with tables of mineral distributions, chemical analyses, and X-ray diffraction traces of clay fractions. Units rest unconformably on Piedmont crystallines, in which pelitic metamorphic rocks are a suggested major source for the sediments. Oldest in the sedimentary basin is the Potomac Group (Early Cretaceous) — Patuxent, Arundel, Patapsco, and Raritan formations. Locally restricted in an innermost NE-SW belt, Pliocene(?) upland gravels (Brandywine or Bryn Mawr) define distinct channel systems, more stratified than the underlying Potomac gravels. Most widespread is the Talbot Formation (Pleistocene? lowland gravels), not marine here but fluviatile, containing silty clay overbank deposit facies. — GDC

01378 **Paine, Robert T.** The sediment occupied by Recent lingulid brachiopods and some paleoecological implications: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 7, no. 1, p. 21-31, illus., tables, 1970.

When living in the intertidal zone, all Recent lingulid species inhabit sediments predominantly composed of sand-sized particles; *Lingula* may inhabit slightly finer sediments than *Glottidia* in the intertidal; for both genera the sediment becomes finer with increasing depth; and lingulids do not appear to inhabit gravel bottoms at any depths. Inferences drawn about the sediments occupied by Paleozoic *Lingula* spp. based on in situ preservation, indicate that fossil species lived in muddy environments with a greater frequency than would have been predicted from the examination of Recent material. This difference in the occupied habitat is discussed in light of recent research on lingulid physiology. — *from* Author's summary

01277 **Paintal, Amreek Singh.** The probabilistic characteristics of bed load transport in alluvial channels [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3659B, 1970.

08831 **Pakiser, L. C.** U.S. Geological Survey research on the tectonics of the San Andreas fault system, California [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 378, 1969.

08832 **Palmer, James E.** Geologic map of the Central City West quadrangle, Muhlenberg and Ohio Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-831, scale 1:24,000, section, text, 1969.

Although coal has been mined in the Central City West quadrangle for many years from several beds, substantial reserves remain. Total production of gas from the Midland pool from 1962-67 was 51 billion cu feet; total reserves are reported as 163 billion cu feet from this thick channel-fill sandstone of the Upper Mississippian Bethel Sandstone. Oil, discovered in 1958, has been produced from the Ste. Genevieve and Paint Creek Limestones and Bethel Sandstone; cumulative production to the end of 1966 was about 140,000 bbl. Limestone from two members of the Lisman Formation may be useful commercially; sandy gravel has been quarried on a small scale. — MCM

Parisis, C. M. *See* VanLoon, J. C. 08610

01095 **Parker, Lee R.** A titanothere from the Eocene Green River Formation of Utah [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 400, 1970.

08472 **Parker, Robert H.** Megafaunal facies, estuary to shelf edge, surrounding the Gulf of Mexico [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 503, 1969.

01117 **Parsley, Ronald Lee.** Studies in Middle Ordovician primitive Echinodermata [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3310B-3311B, 1970.

01222 **Parsons, Barbara Mae.** A palynological investigation of glacial Lake Monongahela sediments [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3515B, 1970.

08654 **Parsons, Roger B.** Geomorphology of the Lake Oswego area, Oregon: Ore Bin, v. 31, no. 9, p. 186-192, illus., 1969.

Geomorphology provides a means of developing a sequence of events. Study of soils and geomorphology in the Tualatin Valley indicates that the abandonment of the Lake Oswego channel was not nearly as long ago as Baldwin (1957) suggests but may have been between 3290 and 5250 years ago. Throughout the Willamette Valley, Winkle surfaces now exist as terraces, peat bogs, or wind gaps. Examples of Winkle surfaces in the Willamette Valley area are Richardson Gap in Linn County, Lake Labish in Marion County, typical stream terraces in Benton County, and Lake Oswego in Clackamas County. Pleistocene stages in the Lake Oswego area are late

Wisconsin and Recent. The Senecal and Champoeg surfaces are about 5250 and 555 years old, respectively. — Author's summary

08652 **Patterson, Peter V.** Sawtooth Ridge — A northeast Oregon volcanic crater: Ore Bin, v. 31, no. 9, p. 173-183, illus., 1969.

This structure, on the southwestern edge of the Wallowa Mts., consists of a shield portion about three miles in diameter, with a central crater about 5,000 feet in diameter. Underlying the structure are pre-Tertiary volcanics and sedimentary rocks. Two radial dikes extend from the central spire to the crater rim and divide the crater; the northeastern dike is better preserved and rises 300 feet above the floor. Both basins have been breached and considerable rim erosion has taken place in the northwestern basin. The rim cap, central spire, and dikes are of platy andesite, like the shield. Two outcrops of pyroclastic ejecta occur within the crater. With the initial structure of a circular or conical type of deposition, the author believes that observed features are probably most consistent with the differential erosion process of crater formation. — ESL

Patton, John B. *See* Becker, Leroy E. 01052

08594 **Pedersen, Edward P.; Royse, C. F., Jr.** Upper-Cenozoic geology of the Payson Basin, Gila County, Arizona [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 37-38, 1969.

08593 **Peirce, H. Wesley.** Coconino and DeChelly Sandstones — Secondary quartz aspects [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 37, 1969.

01263 **Perlmutter, N. M.; Guerrera, A. A.** Detergents and associated contaminants in ground water at three public-supply well fields in southwestern Suffolk County, Long Island, New York: U.S. Geol. Survey Water-Supply Paper 2001-B, p. B1-B22, illus., tables, 1970.

Samplings of shallow observations wells and nearby public-supply wells screened in the upper glacial aquifer showed that detergents were distributed through almost its entire saturated thickness. Concentrations from all wells sampled ranged from <0.02 to nearly 5 mg per *l*; from shallow public-supply wells from about 0.1 to about 1.3 mg per *l*. Chloride concentrations in the aquifer (about 5 to 80 mg per *l*) had an upward trend at some wells apparently due to infiltration of both sewage effluent and deicing salts applied to roads in winter. Nitrate concentrations increased slightly but were below recommended limit for drinking water. No MBAS (detergents) was detected in water from public-supply wells tapping deeper zones in the underlying Magothy aquifer; significant amounts and associated contaminants are unlikely to reach those zones for many years, if present flow patterns and head relations are not markedly changed. — *from* Authors' abstract

Perry, T. G. *See* Anstey, Robert L. 01219

Pessagno, E. A., Jr. *See* Ewing, M. 08532

08547 **Pessagno, E. A., Jr.** Mesozoic planktonic foraminifera and Radiolaria, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 607-621, illus. [1969?].

Mesozoic planktonic foraminifera and radiolarians were encountered primarily in the Bahama area near San Salvador, so the biostratigraphic synthesis deals largely with the Bahama sites. In these cores, foraminifera occurred sporadically in early Maestrichtian to Albian strata, associated with turbidites. Layers barren of foraminifera usually contained radiolarians and coccoliths. The foraminiferal assemblage which appears to be Tethyan, is compared with other occurrences. Radiolaria were common in Early to Late Jurassic. Great faunal changes occurred between the Late Jurassic and Albian, so Radiolaria can be used to develop a detailed system of zonation for this age. A correlation chart for the Mesozoic in the Bahama basin is included, and 48 Radiolaria are figured. — ESL

Peterman, Zell E. *See* Barker, Fred. 08658

01096 **Peters, Walter G.; Wallace, Robert J.; Odom, I. Edgar; Frost, Stanley.** Application of radiography to the study of microfossils in black shales and other sediments [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 400-401, 1970.

01246 **Petersen, Carl Frank.** Shock wave studies of selected rocks [abs.]: Dissert. Abs. International., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3716B, 1970.

08451 **Petersen, W. A.** Uranium on horseback, or South Texas re-visited [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 265, 1969.

Peterson, Donald L. *See* Kleinkopf, M. Dean. 08601

01341 **Peterson, Donald W.** Ash-flow deposits, their character, origin and significance: Jour. Geol. Education, v. 18, no. 2, p. 66-76, 1970.

Research on characteristics of ash flows and related deposits is reviewed. The nuée ardente concept of the origin of ash flows is generally accepted but the mechanism of their transport remains conjectural; the theory of base surge origin has been put forth recently. Nuée ardente eruptions are on a small scale compared to the great ash flows of the world, which took place over a longer period of time and covered areas of up to tens of thousands of square km with deposits up to thousands of meters thick. Calderas are generally considered the source of ash flows but extensive buried fissures also have been suggested as sources. Ash-flow deposits are valuable tools in interpreting stratigraphy, volcanic, and structural history of an area. Petrological, mineralogical, geochemical and isotope-ratio studies of samples, chiefly rhyolitic to dacitic in composition, are useful in determining the character and derivation of silicic magma and of processes within the magma chamber. — EH

01155 **Peterson, Frank L.; Lao, Chester.** Electric well logging of Hawaiian basaltic aquifers: Ground Water, v. 8, no. 2, p. 11-18, illus., 1970.

An extensive program has been conducted to determine applicability of this tool to the volcanic environment. Electric logging techniques were found to be useful, but interpretation of both spontaneous potential and resistivity logs varies from conventional interpretation of electric logs in sediments. These logs pose problems because of the uniform composition of basalts, the complex relation of porosity to resistivity, and because logging is done in water-filled boreholes. Spontaneous potentials are thought to result from fluid flow rather than electrochemical potential so that positive SPs indicate zones of flow into the well, and negative, indicate little flow or flow from the well into the aquifer. Resistivity logs indicate location, number, and thickness of permeable and less permeable formations. High resistivities indicate dense impermeable basalts, and low, the porous permeable zones. — *from* Authors' abstract

01360 **Peterson, M. N. A.; Edgar, N. T.; vonderBorch, C. C.; Rex, R. W.** Cruise leg summary and discussion, Chap. 20 *in* Initial reports of the Deep Sea Drilling Project — V. 2, Leg 2 of cruises of *Glomar Challenger*, Hoboken, N. J., to Dakar, Senegal, Oct.-Nov. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 413-427, illus., tables, 1970.

Two of the five sites drilled are located on the Mid-Atlantic Ridge, and the other three in deep basins. The variety of sediments recovered from the basins suggests that sedimentation and diagenesis may be more complicated in the Atlantic than was anticipated. Six types of sediments and rock, rates of sediment accumulation, hydrothermal mineralization, and diagenesis are discussed. Problems in measuring sound velocity in sediments are reviewed. Ages assigned to Eocene cherts, including reflector Horizon A, are shown on a chart. Sites selected for testing sea-floor spreading, indicate a spreading rate of 1.0 to 1.2 cm/yr. — ESL

01371 **Peterson, M. N. A.; Edgar, N. T.; vonderBorch, C.; Cita, M. B.; Gartner, S.; Goll, R.; Nigrini, C.** Shipboard site reports, Pt. 1 *in* Initial reports of the Deep Sea Drilling

Project — V. 2, Leg 2 of cruises of *Glomar Challenger*, Hoboken, N. J., to Dakar, Senegal, Oct–Nov. 1968: Washington, D.C., U.S. Govt. Printing Office, p. 9-303 illus, tables, 1970.

Site 8 was drilled on the rise between Hatteras and Sohm Abyssal Plains to sample and date the oldest available rock near the continent, and for paleobiologic and paleoecologic information. Site 9 was drilled on the northeastern flank of the Bermuda Rise to examine a sedimentary column where seismic reflectors are absent, and to determine the age of sediments overlying the basement. Site 10 was located on the lower western flank of the Mid-Atlantic Ridge to test the theory of sea-floor spreading, and to check seismic reflectors, and Site 11, on the upper portion of the western flank of the Ridge, to provide evidence pertaining to sea-floor spreading, and to core the Pliocene-Pleistocene boundary. Site 12 was drilled in the Cape Verde basin. Lithologic descriptions, photographs of the cores, and gamma-ray and neutron logs are included. Cretaceous-Tertiary Foraminifera and nannofossils are listed. — ESL

01268 **Peterson, Melvin N. A.** (and others). Initial reports of the Deep Sea Drilling Project — V. 2, covering Leg 2 of cruises of the Drilling Vessel "*Glomar Challenger*", Hoboken, N. J. to Dakar, Senegal, Oct.-Nov. 1968: Washington, D. C., U.S. Govt. Printing Office, 501 p., illus., tables, 1970.

Drilling and coring operations of the Project started in August 1968. This is the first wide-ranging, systematic effort aimed at recovery of cored samples taken completely through the sedimentary layer of the deep ocean basins. Scientific planning has been conducted under the auspices of JOIDES. Cores recovered will furnish reference material for future studies, and a report, describing core material, and information obtained, is published after completion of each cruise. The present report comprises five shipboard site reports, cited as one, and 13 papers, cited separately. A sample list, description of shipboard scientific procedures, and stratigraphic summary charts for each site are given in appendixes. — ESL

08687 **Peterson, N. V.; Groh, E. A.** The ages of some Holocene volcanic eruptions in the Newberry Volcano area, Oregon: Ore Bin, v. 31, no. 4, p. 73-87, illus., tables, 1969.

Several episodes of Holocene volcanism are recorded within the crater and on the flanks of Newberry Volcano, a huge shield volcano rising from the basalt plateau south of Bend. At the summit is a large caldera with two lakes and fresh volcanic features, on its flanks are flows that post-date the volcano; those erupting from a rift extending northwest 20 mi to Lava Butte and beyond are described. Radiocarbon dating of charcoal from tree molds in several flows and hydration-rind dating of obsidian give a sequence of eruptions from 6380 ± 130 to 1270 ± 60 yr.b.p. It is hoped that eventually a chronology of late Quaternary volcanism in the State can be established. — ESL

Peterson, N. V. *See* Walker, G. W. 08725

08741 **Peterson, N. V.** Uranium, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 180-184, illus., table, 1969.

The initiation of the Atomic Energy Commission's uranium procurement program in 1948 sparked a flurry of prospecting in Oregon, and numerous radioactive occurrences were found. Only two, the White King and Lucky Lass, near Lakeview have so far been of economic significance. Total Oregon production amounts to about 200 tons of U_3O_8, principally from the White King mine. The Lakeview area has some reserves, and further exploration and development could increase the potential resources considerably. — MHM

Peterson, N. V. *See* Godwin, L. H. 08758

01312 **Peterson, Warren L.** Bardstown Member of the Drakes Formation in central Kentucky, *in* Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1968: U.S. Geol. Survey Bull. 1294-A, p. A36-A41, illus., 1970.

Phillips, J. D. *See* Opdyke, N. D. 08544

08759 **Phillips, K. N.** Water resources, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 325-369, illus., tables, 1969.

This report pertains to the general characteristics of surface- and ground-water resources with more detailed information about uses, problems, quantity and quality of water resources in the principal drainage basins. Numerous maps, charts, and tables contain data about annual precipitation by area, annual precipitation at selected sites, discharge and runoff, annual flow of certain river basins, and availability of ground water. — MHM

01125 **Pierce, J. W.** Tidal inlets and washover fans: Jour. Geology, v. 78, no. 2, p. 230-234, illus., 1970.

Storm surge attacks on barrier islands from the seaward side, with waves overtopping the barrier, will form washover fans on wide barriers where tidal flats on the lagoon side are extensive. Where barriers are narrow and tidal flats are absent, inlets are cut by this type of attack. Storm surge from the lagoonal side is generally channeled along tidal-flat or dune-field creeks where inlets are readily cut through the barrier. The erosional and depositional processes are directly related to the mass of high water formed on the windward side of the barrier and the corresponding low water level on the leeward side. — *from* Author's abstract

08438 **Pilkey, Orrin H.; Blackwelder, Blake W.; Doyle, Larry J.; Estes, Ernest L.** Environmental significance of the physical attributes of calcareous sedimentary particles, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 113-114, 1969.

Physical attributes of carbonate particles closely reflect environmental conditions. Features such as the degree of aging of shells, particle roundness, particle staining and shelf fragmentation are particularly useful in interpretation of shelf sedimentation. Such particle attributes indicate the relict, shallow water nature of most shelf sediments off the southeastern United States. — Authors' abstract

08675 **Pillmore, Charles L.** Geologic map of the Casa Grande quadrangle, Colfax County, New Mexico, and Las Animas County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-823, scale 1:62,500, section, text, 1969.

Coal beds of commercial thickness and quality occur in both the Raton and Vermejo Formations in Casa Grande quadrangle. In the Raton, coal is high-volatile A to C bituminous in rank, generally of coking quality, and low in ash and sulfur content; Vermejo coals are also of coking quality and usually about the same in rank but contain less volatile matter and more ash. General distribution of the beds in the Raton is reasonably well established from outcrop evidence and shallow drill holes; subsurface extent and condition of beds in the Vermejo are uncertain, but sizable reserves probably remain after alteration and replacement of coal by intruded sills. — MCM

Poché, D. J. *See* Hopkins, E. M. 08468

08817 **Pollack, Henry N.** Dynamic modeling, *in* Models of geologic processes, an introduction to mathematical geology — AGI/CEGS short course lecture notes, Philadelphia, 1969: Washington, D. C., Am. Geol. Inst., p. HP1 — HP33, illus., 1969.

This paper consists of a lecture outline as follows: (1) models in general — reasons for modeling and types of models; (2) characteristics of mathematical models — static:dynamic, structural elements, and probabilistic-deterministic; (3) development of simple geomorphic models, a classroom example; and (4) panorama of examples — geological (sedimentation, terrestrial heat flow, paleontology, morphology, erosion), and other disciplines. Examples in (4) are illustrated by diagrams and charts, and reprints of "Digital model of evaporite sedimentation," by L. I. Briggs and H. N. Pollack (Science, v. 155, no. 3761, p. 453-456, 1967) and "A numerical model of Grand Canyon," by H. N. Pollack (Four Corners Geol. Soc. Guidebook, 5th, p. 61-62, 1969). — MCM

Pomeroy, Paul W. *See* Molnar, Peter. 01298

08784 **Pomeroy, Paul W.** Seismo-acoustic measurements in a highly stressed natural environment [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 400, 1969.

01327 **Poort, Jon M.** Distribution of seismic background noise compared to the major tectonic provinces of the United States [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. a23, 1970.

01175 **Popenoe, Peter; Brinkworth, G. L.; Worl, R. G.; Behrendt, J. C.** Geophysical lineations in north-central Colorado and their possible relationship to Tertiary plutonic activity [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 343, 1970.

01241 **Potter, Noel, Jr.** Rock glaciers and mass-wastage in the Galena Creek area, northern Absaroka Mountains, Wyoming [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3711B-3712B, 1970.

08712 **Poulsen, Christian.** Eigil Nielsen, 16 August 1910-8 December 1968: Kgl. Danske Vidensk. Selsk. Oversigt 1968-69, p. 101-108, portrait, 1969.

08762 **Pow, J. R.** Core and sample storage in Western Canada, *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 362-369, illus., tables, 1969.

About 95 percent of all core recovered from wells drilled for oil and gas in Western Canada is stored in whole or near whole condition at five repositories, two at Calgary and the others at Charlie Lake, Regina, and Winnipeg. This core, if laid out end-to-end, would extend over a distance of 500 mi. It represents an important one or two percent of the total footage drilled to date in Western Canada. Almost 6,000,000 sets of drill cuttings have been washed and placed in single or duplicate vials for permanent storage at the repositories. They represent an important 12,500 mi of drilled footage and account for about one-third of the total footage drilled to date in Western Canada. — Author's abstract

01124 **Powers, William E.** Subdivisions of the Pleistocene ice age in New Zealand, and possible correlation with the glacial sequence in the United States: Jour. Geology, v. 78, no. 2, p. 221-229, illus., tables, 1970.

This paper reviews New Zealand Pleistocene subdivisions and chronology, based mainly on studies by Gage and Suggate of valley and piedmont glacier advances and interglacial marine terracing. Deposits of an early Pleistocene Ross glacial advance were strongly deformed, then deeply eroded prior to four later glacial stages, the Porikan, Waimaungan, Waimean, and Otiran. Tenuous evidence suggests these four may correspond respectively to the Nebraskan, Kansan, Illinoian, and Wisconsinan of central North America. However, C-14 dates indicate that the Otiran ended before the late Wisconsinan Valderan advance of central North America. — DRM

Presley, B. J. *See* Kaplan, I. R. 01357

Presley, B. J. *See* Kaplan, I. R. 08543

01118 **Preston, D. A.** FORTRAN IV program for sample normality tests: Kansas Geol. Survey Computer Contr. 41, 28 p., illus., tables, 1970.

For most geologic investigations, populations are only partially accessible so that their exact nature cannot be determined; however, useful numerical approximations of their probability distributions may be derived if data are drawn in such a manner that they constitute a representative sample of the parent population. The SNORT program tests one or two sample sets for either normality or lognormality using chi-square and Kolmogorov-Smirnov parametric tests; in addition the program computes the mean, standard deviation, coefficients of skewness and kurtosis, and ratio of range of data to standard deviation. In examples of oil and gas field studies, the fields comprise a composite of several populations, and there is an apparent layering of populations between horizons. It is likely that forecasts of discoveries, reserves, or

economic returns made on the assumption of a stationary lognormal distribution will be subject to considerable error. — MCM

Proctor, J. F. *See* Webster, D. S. 01370

08822 **Pronin, A. A.** Kaledonskiy tsikl tektonicheskoy istorii Zemli [Caledonian cycle of tectonic history of the Earth]: Leningrad, Izdatelstvo "Nauka", 232 p., illus., 1969.

Rhythms and synchronism of deformation of the Earth's crust during the Caledonian orogenic cycle are treated comprehensively. On a basis of analysis of more than 2,000 sections throughout the world, and particularly in North America, it is concluded that the stratigraphic breaks and unconformities corresponding to times of uplift and folding are not distributed randomly in the Paleozoic section but rather are concentrated in small intervals of the section in all regions. Such compression of discordances into definite stratigraphic levels of the section indicates epochs of increased tectonic intensity expressed as uplift, folding, and faulting. The bibliography contains 980 citations. — JWC

01097 **Prouty, C. E.** Cambrian sedimentary framework — Appalachian Valley to the northern midwest [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 401-402, 1970.

01098 **Prouty, C. E.** Some Lower Paleozoic sedimentary environments and related paleostructural development — Michigan basin area [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 402, 1970.

08521 **Puri, Harbans S.; Dickau, Bruce E.** Use of normal pores in taxonomy of Ostracoda, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 353-367, illus., 1969.

On the lateral surface of the carapace ostracodes have radial pores of two types: "simple" and sieve. The functions of these two pore types are not fully known. Studies of the carapace with a scanning electron microscope reveal differences between the pores of Myodocopa, Platycopina, Cladocopa, and Podocopina. Sieve pores demonstrate the greatest dimorphism and are confined to the superfamily Cytheracea. A basic pattern of pores was formulated [for four types]. These types can be utilized in future systematic studies of Ostracoda. — Authors' abstract

Pytlak, Shirley. *See* Campbell, K. Vincent. 01190

08697 **Quinn, James Harrison.** Biostratigraphy of the Morrow Group of northern Arkansas: Arkansas Acad. Sci. Proc., v. 23, p. 183-191, illus., 1969.

This Early Pennsylvanian group includes Hale and Bloyd Formations, with distinctive goniatites in fossil assemblages; the Hale is subdivided into Cane Hill and Prairie Grove Members. In the Cane Hill, mostly black silty shale and flaggy siltstone with considerable conglomerate, calcareous sand lenses contain *Reticuloceras*, *Retites* and *Hudsonoceras*. Above is an unnamed pentremital limestone with *Pygmaeoceras*, then discontinuous Prairie Grove sandstone and reef limestones with *Arkanites* and *Baschkirites*. Unconformable on the Hale is Brentwood Member of Bloyd Formation, mostly limestone with *Brannerоceras* among other goniatites, which are also in an overlying unnamed limestone along with *Gaitherites*. Separated from lower Bloyd by coal, Dye Shale and Kessler Members show a partially unique goniatite assemblage; succeeding black shale with *Boesites*, described as Trace Creek Member of the Bloyd, appears rather to be in the Winslow Formation. — GDC

Race, Ronald W. *See* Campbell, K. Vincent. 01190

01328 **Radcliffe, Dennis.** Some applications of combined scanning electron microscopy and electron probe microanalysis [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s23, 1970.

08772 **Raleigh, C. B.; Burford, R. O.** Tectonics of the San Andreas fault system — Strain studies [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 380, illus., 1969.

Results are given for a network of monuments set up for measurement of displacements and strains along the San Andreas fault system. — KAF

08767 **Ramanujam, C. G. K.; Stewart, Wilson N.** Fossil woods of Taxodiaceae from the Edmonton Formation (Upper Cretaceous) of Alberta: Canadian Jour. Botany, v. 47, no. 1, p. 115-124, illus., 1969.

The paper deals with four species of taxodiaceous wood collected in the Drumheller area, Alberta. Two of them are *Taxodioxylon gypsaceum* and *Taxodioxylon taxodii*, the former showing remarkable resemblances with the wood of modern *Sequoia* and the latter with *Taxodium*. Both species are being reported for the first time from the Upper Cretaceous of Alberta. The other two species are new and are named *Taxodioxylon drumhellerense* and *Taxodioxylon antiquum*. *T. drumhellerense* agrees particularly with the wood structure of *Glyptostrobus*. The xylem ray tissue of *T. antiquum* is characteristic in that the rays here are often extremely high (up to 90 cells) and locally as broad as three to four cells. Such high multiseriate rays are seldom encountered among the coniferous woods. — *from* Authors' abstract

Ramírez, N. M. *See* Bello Orta, G. 08630

Ramón Geic, A. *See* García Tijerina, N. 08627

08657 **Ramp, Len.** Dothan(?) fossils discovered: Ore Bin, v. 31, no. 12, p. 145-146, 1969.

While mapping in the Kalmiopsis Wilderness Area in Curry County, Oreg., fossils were discovered in an area mapped as Dothan Formation. The fossils, identified as *Buchia piochii*, a latest Jurassic indicator, were in loose boulders of a dark gray to black, limy argillite along the bank of the Chetco River. Similar rocks are exposed in place along the nearby banks. If the beds on the Chetco are indeed part of the Dothan Formation, then the Dothan is appreciably younger than the Late Jurassic Galice. What is needed now is more detailed mapping within the formation to make sure these rocks are equivalent to those at the type locality for the Dothan, or discovery of *Buchia piochii* at the type locality. — ESL

08718 **Ramp, Len.** Geology of the Klamath Mountains Province, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 47-52, illus., 1969.

The Klamath Mountains Province is a region of rugged topography. In southern Jackson County Paleozoic schists are overlain unconformably by folded Triassic metamorphic rocks. Interbedded Jurassic sedimentary and volcanic rocks, in places strongly metamorphosed, extend from California to a point east of Roseburg. Upper Jurassic-Lower Cretaceous sedimentary rocks are exposed along the western fringe and in down-faulted blocks within the Province, and remnants of Upper Cretaceous marine sediments occur in the Jacksonville-Medford-Ashland area. Most mineralization is related to Upper Jurassic intrusives. Gold, nickel, and chromium have been produced, and olivine, serpentine, feldspar sands, building stone, clay, and soapstone are potential resources. — MHM

Ramp, Len. *See* Wagner, N. S. 08727

Ramp, Len. *See* Thayer, T. P. 08729

Ramp, Len. *See* Brooks, H. C. 08732

Ramp, Len. *See* Hotz, P. E. 08737

08738 **Ramp, Len; Brooks, H. C.** Platinum group metals, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 167-171, illus., 1969.

Known sources of platinum in Oregon are the placer deposits in Josephine County, the black sand beach placers of Coos and Curry Counties, by-product platinum in gold placers in Sumpter Valley, and iridium-bearing gold placers on Bull Run Creek

in Grant County. Potential production of platinum in Oregon is difficult to assess. Coastal black sands contain small reserves; possible placer deposits offshore from Coos and Curry Counties are unevaluated. — MHM

08751 **Ramp, Len; Mason, R. S.** Silica, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 237-241, illus., 1969.

Four deposits in Oregon have been worked for silica: the Bristol Silica quarry in Jackson County, the Quartz Mountain deposit in Douglas County, the Eugene Silica sand in Lane County, and the Hugo Pegmatite in Josephine County. In addition to these four, there are extensive deposits of chert and impure quartzite in northeastern and southwestern Oregon. Known reserves of high-purity quartz, such as the Bristol deposit, are limited; however, there are large resources of lower grade silica for which the future market potential appears to be growing. — MHM

Ramp, Len. *See* Wagner, N. S. 08798

01242 **Rampton, Vernon Neil.** Pleistocene geology of the Snag-Klutlan area, southwestern Yukon, Canada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3712B, 1970.

08612 **Ranken, R. E.; Scheidegger, A. E.** An application of isallo stress analysis to areas in Tanzania, Texas and Alaska: Pure and Applied Geophysics, v. 75, p. 102-116, illus., 1969.

This paper is a further one in the series presenting applications of isallo stress analysis to the investigations of the tectonic stresses in the various areas of the world. Specific areas in Tanzania (near the East African Rift Valley), in Texas and in Alaska are investigated and a discussion of the tectonic stresses prevalent therein is given. — Authors' summary

01249 **Rao, Manam Venkata Panduranga.** Effects of effluent and influent seepage on the hydrodynamic forces acting on an idealized noncohesive sediment particle [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3659B, 1970.

08692 **Rateev, M. A.; Gorbunova, Z. N.; Lisitzyn, A. P.; Nosov, G. L.** The distribution of clay minerals in the oceans: Sedimentology, v. 13, nos. 1-2, p. 21-43, illus., 1969.

The authors carried out quantitative X-ray determinations of clay minerals in sediments of the Indian and Pacific Oceans using the Biscaye-method. The latitudinal localization of clay minerals in the bottom sediments of the world ocean is determined with the help of schemes of area localities. Two groups of minerals are distinguished according to their location. The first group consisting of kaolinite, gibbsite and montmorillonite, is concentrated in maximum quantities in tropical-humid zones (mainly in the latitudes 35°N and 35°S), and has an "equatorial"-type distribution. The second group containing chlorite and illite is located in moderate and high latitudes, chiefly with cold, moderately humid and ice zones forming a so-called "bipolar"-type distribution. — *from* Authors' abstract

01099 **Rau, Jon L.** Environmental hydrology of the Akron metropolitan area, Ohio [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 402-403, 1970.

Rau, Weldon W. *See* Snavely, Parke D., Jr. 08649

01329 **Ray, Clayton E.; Lipps, Lewis.** Southerly distribution of porcupine in eastern United States during late Quaternary time [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s24, 1970.

Reel, D. A. *See* Griffin, G. M. 08526

Repenning, C. A. *See* Newcomb, R. C. 01192

Reser, Margie K. *See* Levin, Ernest M. 08704

Reshkin, Mark. *See* Schneider, Allan F. 01102

01354 **Rex, R. W.** X-ray mineralogy studies, Leg 2, [Chap.] 11 *in* Initial reports of the Deep Sea Drilling Project — V. 2, Leg 2 of cruises of *Glomar Challenger*, Hoboken, N. J., to Dakar, Senegal, Oct.-Nov. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 329-346, illus., tables, 1970.

X-ray powder diffraction, using the method of mutual standards, mutual ratios, or multiple ratios, is useful for semiquantitative ranking of relative mineral abundances; the technique used here is described. The presence or absence of a mineral in these computer prepared lists does not necessarily mean that it is present or absent from the sediment, but represents the present degree of development of recognition criteria. Results are described by sites and tabulated. — ESL

Rex, R. W. *See* Peterson, M. N. A. 01360

08537 **Rex, R. W.** X-ray mineralogy studies — Leg 1, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 354-367, tables [1969?].

Semiquantitative analyses of crystalline components in sediments can be made by X-ray powder diffraction techniques. Minerals for which calibrations are available are given at the head of data tables. The analytical system used a lithium fluoride diffracted beam monochromator which excludes everything but copper Kα radiation. The samples were ground and washed free of sea salts so diffraction patterns show little trace of halite and gypsum. Data indicate that many deep-sea cherts are in the metastable intermediate sedimentary cristobalite stage. — ESL

Rexroad, Carl B. *See* Barnes, Christopher R. 01049

08631 **Reyes Domínquez, E.** Resultados y consideraciones de la exploración en la Cuenca de Veracruz [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 85, 1969.

Reynolds, J. R. *See* Harper, H. E. 08809

Rezak, Richard. *See* Chmelik, Frank B. 08435

08439 **Rezak, Richard; Bouma, Arnold H.; Jeffrey, Lela M.** Hydrocarbons cored from knolls in southwestern Gulf of Mexico, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 115-118, illus., table, 1969.

Some of the piston cores collected from knolls in the southwestern part of the Gulf of Mexico contained either layers of solid hydrocarbons or scattered inclusions of this material. Geochemical analyses indicate that the hydrocarbons contain about 50 percent asphaltenes. Comparisons are made from samples within a 58 m thick tar layer and between the tar layer and the inclusions. Paleontological investigations on coccoliths and foraminifera reveal that mixing of fossil assemblages is common suggesting upward movement of sediment with the hydrocarbons. These findings demonstrate that hydrocarbons can originate in deep sea sediments and that their upward movement results in "oil seeps" which may account for some of the hydrocarbons found on modern beaches. — Authors' abstract

01100 **Rhodes, F. H. T.** Conodont research — Problems, programs, and priorities [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 403, 1970.

01101 **Rhodes, Frank H. T.; Williams, John A.; Austin, Ronald L.** Micromorphologic studies of conodonts [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 403-404, 1970.

Rice, Donald A. *See* Schwimmer, Philip M. 08569

Richards, Adrian F. *See* Bryant, William. 08456

Richards, Adrian F. *See* Miller, Donald G., Jr. 08661

08481 **Richards, Horace G.** A review of recent studies on the marine Pleistocene of the Atlantic Coastal Plain — New Jersey to Georgia, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 601-609, 1969.

An attempt is made to correlate the more than 50 formations and physiographic names suggested in recent literature on the marine Pleistocene of the Atlantic Coastal Plain. There is evidence of a Sangamon high sea level at about 28 and possibly 42 feet. No higher Pleistocene shorelines have been demonstrated in Maryland, Delaware, or New Jersey. There is evidence of a 100-ft shoreline in Virginia, South Carolina, and Georgia. This shoreline has been referred to the Wicomico Formation and is tentatively regarded as Yarmouth in age. Terraces above the 100-ft contour are probably nonmarine and may be Tertiary. Warping and Holocene submergence is indicated for New Jersey, and various geologists suggest that along the southeastern coast, eustatic fluctuations may have been superimposed on a tectonically rising coast. There is evidence of a mid-Wisconsin high stand of the sea. — *from* Author's abstract

08541 **Riedel, W. R.; Hays, J. D.** Cenozoic Radiolaria from Leg 1, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 400-402, illus., table [1969?].

Cenozoic radiolarian samples were taken at one level each at Sites 3 and 7, and nine levels at Site 6. At Site 3 radiolarians are very rare and evidently reworked; at Site 6 they occur in an Eocene sequence, apparently turbidites. Some of the more easily recognizable specimens are shown in a table. Because of the great amount of reworking, it is difficult to determine which forms are the same age as the sediments. Many species can be identified throughout the section, but some are restricted to the upper samples and may prove useful in correlating the Eocene. At Site 7, Eocene radiolarians are evidently in situ. — ESL

08576 **Rietman, Jan D.** Gravity surveys in the western Transverse Range Province, California, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 545-546, illus., 1969.

The Transverse Range Province of California, which contains the major east-west trending structural features of southern California, extends from the coast where the Santa Ynez Mountains plunge into the Pacific Ocean eastward to within fifty miles of the Colorado River. This paper summarizes briefly recent gravity work in that portion of the province west of long 118°30′. The approximate boundaries of seven gravity surveys that are either in progress or have been completed since 1965 are shown in a figure; major anomaly patterns are discussed. — GV

08660 **Rimsaite, Jadvyga.** Evolution of zoned micas and associated silicates in the Oka carbonatite: Contr. Mineralogy and Petrology, v. 23, no. 4, p. 340-360, illus., tables, 1969.

Thin section study of Oka carbonatite revealed zoned pyroxene, amphibole, mica and carbonate which were studied by electron probe for the relation between optical zoning and chemical composition. Study of zoned micas by various means indicated two- to ten-fold variations in ionic proportions of Ti, Fe, and Al, and lesser variations in concentrations of Mg, Si, and K in six different mica zones. Relations between major constituents is more complex; Fe and Mg exhibit opposite trends, modified by prominent variations in Al and Ti. Gradual variations within zones are accounted for by gradual differentiation of the magma. Abrupt changes in chemistry between zones, coinciding with optical boundaries, indicate sudden changes in environment. High Fe and Ti-Al zones are markers for correlating cogenetic zones in pyroxene, amphibole, and mica, and for periods of crystallization of Fe-Ti minerals. — *from* Author's abstract

08766 **Ritchie, J. C.** Absolute pollen frequencies and carbon-14 age of a section of Holocene lake sediment from the Riding Mountain area of Manitoba: Canadian Jour. Botany, v. 47, no. 9, p. 1345-1349, illus., table, 1969.

A section of Holocene lake sediment in the Southern Boreal Forest of Manitoba was re-sampled, and the sedimentation rate (0.039 cm per annum) calculated from eight C-14 age determinations. Pollen accumulation rates were computed, and an absolute pollen frequency diagram constructed. It suggests modifications of an earlier reconstruction of vegetation, based on relative pollen frequencies. A spruce-dominated assemblage occurred from about 11,500 to 10,000 B.P., when there was a change to a treeless vegetation of a grassland type. This persisted until about 2500 B.P., with the possible interpolation of an aspen parkland phase from 6500 to 2500 B.P. The boreal forest in its present form (dominated by spruce, birch, and aspen, with local occurrences of pine, fir, larch, and oak) returned at 2500 B.P., presumably in response to a deterioration in climate (cooler and/or wetter). — Author's abstract

Ritter, Dale F. *See* Born, Stephen M. 01252

08684 **Riva Palacio, E.; Cavazos, S.** *Heterostegina* D'Orbigny 1826, del Oligoceno Superior de dos pozos del noreste de México: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 31-37, illus., 1969.

The authors discuss species of the genus *Heterostegina* and associated forms, found in samples from the upper Oligocene from 2 wells in the state of Tamaulipas, Mexico. — *from* Authors' abstract

Robbins, Carl R. *See* Levin, Ernest M. 08704

Robbins, Stephen L. *See* Barnes, David F. 08570

08805 **Robertson, David S.; Douglas, Richard F.** The uranium exploration situation: Mining Cong. Jour., v. 55, no. 1, p. 30-33, illus., 1969.

Industry is short today on lifetime fuel for reactors in operation or planned, by about 132,000 tons, and there will probably be a critical shortage by 1982. Geochemically, uranium is a lithiophile element, and its distribution will follow that of zircon, monazite, rutile, and beryl, rather than sulfides. Lithiophile minerals tend to be concentrated by weathering, and it seems unlikely more economic concentrations of large quantities will be found. Reserves in Canada are estimated to be 200,000 tons of U_3O_8, mostly in the Elliot Lake area. Reserves in the western United States are discussed; less than 50 million pounds net has been added in 1968. — ESL

08840 **Robertson, J. W.** New life begins for Alberta's Keg River pinnacle reefs: World Oil, v. 169, no. 4, p. 87-90, illus., 1969.

The Rainbow-Zama area, which now accounts for 10 percent of Alberta's crude oil reserves, was believed to have little potential four years ago. New reef production was discovered and prospects for increased production now look much better. — *from* Author's abstract

08479 **Robinson, E.** Coiling directions in planktonic foraminifera from the Coastal Group of Jamaica, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 555-558, illus., 1969.

Dominant coiling directions were noted in the *G. menardii*, *G. acostaensis*/*G. dutertrei* and *G. crassaformis*/*G. truncatulinoides* groups in the middle Miocene to Pleistocene Coastal Group of Jamaica. At least some of the coiling changes appear to have regional correlative value in the Caribbean and Gulf of Mexico. — *from* Author's abstract

08677 **Robinson, G. D.; McCallum, M. E.; Hays, W. H.** Geologic map of the upper Holter Lake quadrangle, Lewis and Clark County, Montana: U.S. Geol. Survey Geol. Quad. Map GQ-840, scale 1:24,000, sections, 1969.

08512 **Robinson, S. C.** International aspects of geological data storage and retrieval, *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 319-329, 1969.

Geological data on an international scale will be used for development and testing of concepts and theory, as a basis for assessing mineral potential and even individual mineral deposits, for establishment of worldwide norms averages and standards, and as a search tool leading to sources of specific data and to repositories of specimens, etc. International committee activities are designed to establish acceptable general standards for reference numbering, geographic location, geological terminology, coding, etc., and to develop progressively types of data that should be recorded in specialized archival files in all fields of geology. Establishment of world data banks may come later; for the present the aim is to achieve some degree of agreed consistency in national and local data banks throughout the world, and to establish an international index to these banks. — *from* Author's abstract

08617 **Rodríguez Santana, E.** Sedimentos de Oligoceno de la Cuenca de Burgos [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 80, 1969.

08452 **Roehl, Perry O.** Permeability anisotropy in microsucrosic dolomites [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 265, 1969.

01131 **Roen, John B.** Sandstone distribution in lower member of Waynesburg Formation, Greene and Washington Counties, southwest Pennsylvania — Discussion [of paper by W. D. Martin and B. R. Henniger, 1969]: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 3, p. 532-534, illus., 1970.

The so-called "Mather Sandstone Lentil" of the Waynesburg Formation (Martin and Henniger, ibid., v. 53, no. 2, p. 279-298, 1969) refers to a sandstone unit whose boundary as yet cannot be clearly defined geographically. The lower and upper limestone members of the Washington Formation are more distinctive and extend over a wider area than the "Mather Sandstone Lentil" or the "Hockingport Sandstone Lentil," as defined by Martin and Henniger. — *from* Author's summary

01171 **Rogers, J. J. W.; Condie, K. C.; Mahan, S.** Significance of thorium, uranium, and potassium in some early Precambrian graywackes from Wyoming and Minnesota: Chem. Geology, v. 5, no. 3, p. 207-213, tables, 1970.

Th, U, and K concentrations have been measured by gamma-ray spectrometry in graywacke sequences from the Wind River Mountains of Wyoming and the Knife Lake area of Minnesota. Th concentrations are compatible with clay, quartz, and lithic contents of the rocks, but the U contents are low, thus yielding Th/U ratios of 5 or above. Assuming that all post-depositional elemental abundance variations in the graywackes have been caused solely by radioactive decay since the rocks were formed, the initial Th/U ratios would have been in the range of 3-4. If the graywackes are random samples of the continental crust at their time of formation, then these data support data of Fahrig and Eade (1968) to the effect that the continental crust 3 b.y. ago had a Th/U ratio significantly higher than that of the whole earth. — *from* Authors' summary

08440 **Rogers, James K.** Possible ground water influence on the habitat of oil in the Gulf Coast, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 119-130, illus., 1969.

Within the geologic setting of the Gulf Coast the regional movement seaward of ground water has a significant effect on some phases of oil and gas movement and concentration. Evidence is cited which indicates that the beginning of hydrocarbon formation comes fairly soon after deposition of sediments. Effects of ground water on oil or gas accumulation may be separated into those in shallow, relatively unconsolidated sediments with high water content, and those at greater depths where shales are moderately compacted and where fluid movement is mainly through sands, silts or permeable carbonates. Evidence in the first case comes mainly from studies of modern sediments, ground-water hydrology, and geochemistry. In the second, evidence rests upon data from subsurface geology and from the history and distribution of hydrocarbon reservoirs. — *from* Author's abstract

08478 **Rogers, M. A.; Koons, C. B.** Organic carbon δ C-13 values from Quaternary marine sequences in the Gulf of Mexico, a reflection of paleotemperature changes, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 529-534, illus., 1969.

Variations in stable carbon isotope ratio values on combustible organic matter in Gulf of Mexico sediments correlate with Pleistocene warm and cold climates. Warm stages are characterized by C-13/C-12 ratios of -20 to -22 per mille, compared to PDB standard, while colder stages are characterized by -24 to -26 per mille. Piston core samples from the present bottom show similar δC-13 values (-20 to -22 per mille) characterizing warm postglacial period regardless of bathymetric environment except where relict Pleistocene sediments crop out. Samples from 1000 ft cores on the present slope represent post-Pliocene sequences; δC-13 values alternate from more positive to more negative, coinciding with glacial-interglacial stages. Interpretations of data indicate that the principal reason for observed correlation is variation of water temperatures in the photosynthetic zone. — *from* Authors' abstract

Romig, P. R. *See* Major, M. W. 08778

Rona, E. *See* Bonatti, E. 08475

08527 **Rona, Elizabeth; Dorta, Clara C.** Geochemistry of uranium in the Cariaco Trench [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 264, 1969.

01120 **Rona, Peter A.** Submarine canyon origin on upper continental slope off Cape Hatteras: Jour. Geology, v. 78, no. 2, p. 141-152, illus., tables, 1970.

The configuration of sedimentary strata revealed by seismic reflection profiles over submarine canyons off Cape Hatteras is best explained by the hypothesis of composite (both erosional and constructional) origin of submarine canyons. The canyons were originally incised into a post-Miocene(?) surface of unconformity. Intercanyon areas were raised by deposition of up to several hundred meters of sediment while the canyons were maintained by sediment removal along the original incisions. Canyon heads are now buried under a sediment cover which extends down to about 400 m below sea level, where the canyons emerge. The depth of emergence of canyons approximately coincides with the inferred level of no motion between the northeast-flowing (surface) Florida Current and the southwest-flowing Western Boundary Undercurrent. — *from* Author's abstract

Ross, C. S. *See* Smith, R. L. 01208

Ross, Clyde P. *See* Nelson, Willis H. 08801

08689 **Ross, D. S.** Color enhancement for ocean cartography, [Chap.] 5 *in* Oceans from space (P. C. Badgley, L. Milroy, and L. Childs, editors) — Symposium, Houston, Tex., Proc.: Houston, Tex., Gulf Publishing Co., p. 50-63, illus., 1969.

Of all the remote, image-forming sensors planned for use in resources programs, the camera provides the highest spatial resolution. The Gemini photographs are only a foretaste of what is to come; the multispectral film or electric space camera is the only sensor which directly records information below the ocean surface. Experiments with simple photographic masking and density contouring processes to enhance very small color and radiance differences in one image over the Bahama Banks, aid interpretation and provide a basis for water-depth assessment. The techniques can be used with a single spectral photorecord in the region of maximum light transmission in the water, or in combination with several different spectral records. With careful photometric calibration and sensitometric control, multispectral photography probably can yield quantitative information of value on the depth of shallow waters in many parts of the world. — GDC

01280 **Ross, June Phillips.** Distribution, paleoecology and correlation of Champlainian Ectoprocta (Bryozoa), New York State, Pt. 3: Jour. Paleontology, v. 44, no. 2, p. 346-382, illus., tables, 1970.

Transgressive and regressive carbonate facies of the Middle Ordovician Champlainian sequence of the southeastern side of the Ontario basin have a diverse bryozoan fauna of 40 distinguishable species of trepostomes, cryptostomes, and cyclostomes. This concluding part of a biostratigraphic study describes the remaining seven trepostome and one cryptostome species and includes two new genera, the trepostome *Champlainopora* (type species *C. chazyensis* Ross) and the cryptostome *Pseudostrictoporella*, and two new species, *P. typicalis* (type species of foregoing genus) and the trepostome *Montrypella boonvillensis*. The bryozoans lived in a wide range of shallow carbonate shelf environments similar to those of the Recent Florida and Bahama banks and shelves; many colonies were transported and deposited as mixed assemblages. — *from* Author's abstract

01180 **Rowan, Lawrence C.; Larsen, Leonard H.** Precambrian history of the Beartooth Mountains-Hellroaring Lakes area, Montana [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 347, 1970.

Royse, C. F., Jr. *See* Pedersen, Edward P. 08594

Rubin, Meyer. *See* Sullivan, Beverly Marsters. 01382

01209 **Russell, R. Dana.** SEPM history, 1926-1946: Jour. Paleontology, v. 44, no. 2, p. 173-194, illus., 1970.

This address marked the occasion of the Society of Economic Paleontologists and Mineralogists founders' dinner in Dallas, Tex., April 1969. The history of the first 20 years of the Society is outlined, including initial publication of the Journal of Paleontology in 1927, publication of the Journal of Sedimentary Petrology in 1931, joint publication of Journal of Paleontology by SEPM and Paleontological Society in 1935, and periodic wrangling and financial crises. Brief biographic sketches are given for some of the 89 charter members and officers for the first 20 years. The story is based mostly on personal correspondence of charter members and early officers. — VMJ

08565 **Rutherford, Malcolm J.** An experimental determination of iron biotite-alkali feldspar equilibria: Jour. Petrology, v. 10, no. 3, p. 381-408, illus., tables, 1969.

Experimental work in the system $KAlSiO_4$-$NaAlSiO_4$-SiO_2-Fe-O-H indicates that approximately 20 mol percent of sodium annite can enter into solid solution with potassium annite, measurably reducing the stability of the assemblage iron biotite-alkali feldspar. The results of investigation of the various reactions limiting the stability of biotite suggest that it will be unstable in the presence of granitic liquids at pressures below 4 kb, given a low fluorine and titanium content. Variations in the Na/K ratios of the feldspars may be responsible for variations in the Fe/(Fe+Mg) ratio of biotite, otherwise attributable to changing temperature, and in certain cases may result in complete breakdown of biotite or, in other cases, in its crystallization. — MS

08782 **Ryall, Alan.** Studies of aftershocks and earthquake swarms in the Nevada region [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 399, 1969.

08540 **Sachs, K. N., Jr.** Report on larger foraminifera from sites 4 and 5, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 398-399 [1969?])

Many of the identifications are tentative or questionable due to the poor state of preservation, and some are based on single specimens. However, the age ranges are well documented and tie in with results of other studies. Foraminifera are listed from nine Tertiary and seven Cretaceous samples. — ESL

08519 **Sackett, W. M.; Cook, G.** Uranium geochemistry of the Gulf of Mexico, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 233-238, illus., tables, 1969.

The economic importance, the dissimilarity in chemical behavior of its two oxidation states and the unique usefulness of its radioactive daughter products make uranium and its geochemistry extremely interesting to earth scientists. The Gulf of Mexico (GOM) has the attractive feature of being a semiclosed system that offers the possibility of a complete monitoring of all inputs and removal processes for trace elements such as uranium. Experimental values obtained in this study of the geochemical cycle of uranium in the GOM are [tabulated]. High uranium concentrations in midwest United States rivers relative to other rivers of the world can be explained by solubilization of the uranium in phosphate fertilizers applied to the land surface. Estimated pre-fertilizer uranium input to the GOM is nearly balanced by uranium codeposition with carbonates on the Yucatan shelf. — Authors' abstract

08640 **Salinas E., S.** Problemas de exploración en áreas posiblemente petrolíferas de la República Mexicana, Golgo Sabinas [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 90, 1969.

08636 **Sánchez Montes de Oca, R.** Estratigrafía y paleogeografía del Mesozoico de Chiapas [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 87-88, 1969.

08618 **Sandoval C., M. J.** Interpretación sedimentaria del Oligoceno Inferior en la Cuenca de Burgos [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 80, 1969.

08668 **Saperstein, L. W.** Mining engineering education and nuclear explosives: Earth and Mineral Sci., v. 39, no. 3, p. 17-19, 24, illus., 1969.

The nuclear explosive, like any other, is capable of only two actions: creation of a shock wave in the surrounding medium, and formation of gaseous reaction products. If the desired product is broken rock, the nuclear explosion is a valuable tool. Configurations are divided into those which are contained and those which crater. The role of the university in training people for projects like Plowshare is discussed. The Mining and Nuclear Engineering Departments at Pennsylvania State University offered a course in Plowshare techniques cooperatively in the Spring of 1969. Major divisions were nuclear sciences, earth and mechanical sciences, and Plowshare applications. The course will be offered again whenever there is sufficient demand. — ESL

Sass, Daniel B. *See* Barnes, Christopher R. 01050

08592 **Saunders, Jeffrey J.** The distribution of *Mammuthus* in Arizona [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 36-37, 1969.

Savino, John. *See* Molnar, Peter. 01298

Sayles, F. L. *See* Manheim, F. T. 08542

Scheidegger, A. E. *See* Ranken, R. E. 08612

08750 **Schlicker, H. G.** Sand and gravel, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 233-237, illus., table, 1969.

The combined values of sand, gravel, and stone rank first in Oregon's mineral industry. Sand and gravel occur in several types of deposits, chief of which are stream channels, floodplains, alluvial fans, and deltaic deposits. Large deposits of sand and gravel occur in the floodplain of the Willamette River, and the Columbia River supplies large quantities of gravel. Deltaic sands and gravel occur southeast of Portland. Economic production of these commodities commonly is limited to deposits within a 20-mile radius of expanding urban areas; therefore, resources are difficult to assess. — MHM

01102 **Schneider, Allan F.; Reshkin, Mark.** Age and correlation of the Glenwood stage of glacial Lake Chicago [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 404, 1970.

Scholl, D. W. *See* Marlow, M. S. 01376

08590 **Scholtz, Judith Fessenden.** Structural control of the Stoneman Lake basin [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 36, 1969.

08609 **Scholtz, Judith Fessenden.** Evidence for revision of the name Hickey Formation east of the Verde Valley, Coconino County, Arizona: Arizona Acad. Sci. Jour., v. 5, no. 3, p. 182-183, illus., 1969.

Beneath the volcanic Beaver Creek watershed, in highway cuts south from Sedona to Rimrock, an erosion surface bevels Kaibab to older Supai strata. At the north end, basalt rests directly upon it; at the south end, lake beds of the Verde Formation separate it and overlying lavas which intertongue with them. Prelava Tertiary streams from the Mormon Lake region, following north-south fractures, carved a broad valley across the Mogollon Rim; there the Hickey Formation was uplifted and eroded before Verde deposition. Cascading over the Mogollon Rim, oldest lavas in the Beaver Creek watershed lie above and intertongue with the lake beds; they are younger than the Hickey. This overlap and structural drainage changes indicate northeastward migration of tectonics and volcanics. Change of stress direction in faults coincident with flows caused shear sets to move counterclockwise. — GDC

01243 **Schwarzer, Theresa Frances.** The distribution of major and trace elements in coexisting feldspar pairs from selected pegmatites in New York State [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3712B-3713B, 1970.

08569 **Schwimmer, Philip M.; Rice, Donald A.** U.S. National Gravity Base Net, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 527-528, illus., 1969.

A U.S. National Gravity Base Net, soon to be published by the Coast and Geodetic Survey, is described. The net consists of bases located in 59 cities throughout the conterminous United States. Measurements were made with the LaCoste-Romberg gravimeter. — GV

08562 **Scott, Glenn R.** Geologic map of the southwest and southeast Pueblo quadrangles, Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-597, scale 1:24,000, 1969.

Scott, Harold W. *See* Melton, William. 01085

Scott, W. Frank. *See* Alwin, John A. 01193

01364 **Scott, Ward M.; Modzeleski, Vincent E.; Nagy, Bartholomew.** Pyrolysis of early Pre-Cambrian Onverwacht organic matter ($>3 \times 10^9$ yr old): Nature, v. 225, no. 5238, p. 1129-1130, illus., table, 1970.

The Onverwacht kerogen has been analyzed in the hope that this might elucidate the nature of the carbon compounds present on the Earth 3.5 b.y. ago. The Onverwacht samples contain mainly aromatic degradation products of the kerogen, while the overlying Fig Tree series shows an abundance of n-alkanes. It is difficult to account for an aromatic-type kerogen from biological sources in early Precambrian times, long before the appearance of the abundant aromatic biochemical, lignin. It is not possible to conclude that life first arose in Fig Tree times until the entire Fig Tree and Onverwacht have been studied and compared and until the relative metamorphic effects which may lead to aromatization have been compared and evaluated. — DBV

01317 **Segula, Maurice K.** Value of geophysical methods in finding soft iron ore in northern Canada: Soc. Mining Engineers AIME Trans., v. 247, no. 1, p. 14-22, illus., 1970.

In searching for enriched soft iron ore deposits in drift-covered areas in the central Labrador Trough, New Quebec, a qualitative interpretation of a combined gravity-magnetic-seismic-resistivity, a gravity-magnetic-seismic, or a gravity-magnetic-resistivity survey permits detection of iron formations and ore zones and their delineation from country rocks. Most altered iron formations increase in density through enrichment and geochemical alteration changes their magnetic properties. Quantitative correlations were done for many deposits: (1) correlation of residual gravity anomaly intensities with specific gravity, iron or silica content, porosity factor, and dimensions of underlying ore bodies; and (2) correlation of ground magnetic intensity relative to a reference lithologic unit with the percentage of Fe_3O_4 recovery and with volume of ferromagnetic susceptibility. — *from* Author's abstract

08819 **Seiglie, George A.** Notes on species of the genera *Buliminella* and *Bulimina* (Foraminiferida): Caribbean Jour. Sci., v. 9, nos. 3-4, p. 93-116, illus., 1969.

The evolution of two groups of *Buliminella* is shown: the South American group that includes striated species and the North American group with smooth walled species. Several species of *Bulimina* and *Buliminella* are discussed, including the following new species and subspecies: *Buliminella curta praesilviae* subsp. nov., *B. mississippensis* sp. nov. and *B. picaensis* sp. nov. — Author's abstract

08821 **Seilacher, Adolf.** Fault-graded beds interpreted as seismites: Sedimentology, v. 13, nos. 1-2, p. 155-159, illus., 1969.

[At Elwood Beach, north of Santa Barbara, Calif., steeply dipping beds of Monterey Shales, truncated and sand-polished in the upper coastal platform, have three major and a few minor fault-graded beds.] Fault grading is expressed by a regular structural sequence of liquified zone, rubble zone and step-faulted zone, with gradational contacts between these zones and the bottom, but with a sharp boundary at the top. It is interpreted as an effect of strong earthquakes on gradationally compacted muds in quiet water basins. Fault-graded beds are geopetal and paleoslope criteria. If interpreted as seismites they may also be used as paleoseismograms. — *from* Author's abstract

08714 **Seki, Y.; Ernst, W. G.; Onuki, H.** Phase proportions and physical properties of minerals and rocks from the Franciscan and Sanbagawa metamorphic terranes, a supplement to Geological Society of America Memoir No. 124: Tokyo, Japan Society for the Promotion of Science, 85 p., tables, 1969.

Twenty-three tables of data are presented as documentation to accompany a comparative study in low-grade metamorphism in the California Coast Ranges and Shikoku, Japan, by Ernst and others (in press). In the first 18 are micrometric modes for 830 thin sections, representing nearly 700 rock samples; bulk densities have been measured for 355 of these. Selected optical and/or X-ray properties are listed in Tables 19-22 for more than 1100 phases from those specimens. The frequency of $CaCO_3$-bearing assemblages from 499 *in situ* metamorphic rocks of the Goat Mountain, Pacheco Pass, Shirataki and Oboke areas are given in Table 23. These data, combined with chemical and microprobe analyses, field and petrographic relationships set forth by Ernst and others provide essential evidence for their conclusions regarding contrasting blueschist facies metamorphism in Franciscan and Sanbagawa terranes. — GDC

01103 **Sendlein, Lyle V. A.; Henkel, Donald.** Preglacial bedrock topography of southwestern Iowa [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 405, 1970.

01139 **Sharma, Ghanshyam D.** Sediment-seawater interaction in glaciomarine sediments of southeast Alaska: Geol. Soc. America Bull., v. 81, no. 4, p. 1097-1105, illus., table, 1970.

The chemical composition of interstitial waters and the mineralogy of recent glaciomarine sediments from southeastern Alaska were determined to study the interaction between sediment and sea water. Differences in chemical composition of

overlying and interstitial waters of bottom sediments reflected the nature and extent of sediment–sea water interaction. Such interaction depends on bulk mineralogy and particle size of sediments, environment of deposition, and path length the sediments follow prior to deposition. During transport and early stages of burial, cation exchange is the major process responsible for changes in the composition of interstitial water and sediments. Analysis of interstitial waters of cores indicated maximum variations with depth in sodium ion concentration, followed by calcium and magnesium ion concentrations. — Author's abstract

Shaw, George H. *See* Campbell, K. Vincent. 01190

08566 **Shaw, Herbert R.** Rheology of basalt in the melting range: Jour. Petrology, v. 10, no. 3, p. 511-535, illus., tables, 1969.

Results of viscosity measurements on tholeiitic crystal-liquid suspensions are reported and discussed relative to possible extrapolations to more concentrated suspensions. The experimental data indicate that heat of deformation exerts an effect on rheologic behavior in the melting range. The temperature dependence of viscosity is used as a basis for constructing an equation of thermal energy balances and their rates of change, derived from solutions relating shear stress, rate of strain, and temperature. The thermodynamic mechanisms postulated may account for processes of magma generation and deep-focus earthquakes, both of which may ultimately be related to a gravitational energy source. — MS

Shearer, Gerald B. *See* Nelson, Dennis O. 08686

08763 **Shearman, D. J.; Fuller, J. G.** Anhydrite diagenesis, calcitization, and organic laminites, Winnipegosis Formation, Middle Devonian, Saskatchewan, *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 496-525, illus., table, 1969.

Calcareous, dolomitic, and anhydritic layers with organic partings floor parts of the Winnipegosis salt basin of western Canada. Before compaction, part of the anhydritic laminate was altered to crystalline calcite that enclosed anhydrite and organic matter, preserving features of original sediment grown as nodules in an organic substrate. The crystal fabrics resemble those of Recent sabkha anhydrites, mode of growth being apparently identical; enterolithic structure resulted from buckling sheets of coalesced nodules within confining laminae. Varieties of anhydrite fabric are products of compaction, with range related to compressibility and drainage. Originally resembling blue-green algal mat, organic material was a large fraction of the sediment even after anhydrite-nodule growth. Stratigraphically, the presence of algal mat and nodular anhydrite on the basin floor implies nearly complete loss of water after reef formation, and before halite accumulation. — GDC

08836 **Sheldon, Richard P.** World phosphate resources: Mining Cong. Jour., v. 55, no. 2, p. 115-118, illus., 1969.

The subject of world phosphate resources, in order to be meaningful, must be placed in the context of world demand which has been soaring in recent years. While phosphate, occurring as apatite, is not so abundant, there is enough found by industry to meet the foreseeable demand; one-third of the reserves are in the United States. Three phases in the geochemical cycle of phosphorus contribute economic deposits. Most phosphate, 74 percent, comes from ancient marine deposits, occurring in areas of upwelling ocean currents, mainly on the west coasts of continents. Igneous phosphate deposits, 24 percent, are found in complexes of carbonatites, with associated nepheline syenite and alkaline ultramafic rocks. The only deposits being mined extensively are in the U.S.S.R. and Transvaal. Two percent of the total comes from bird guano. — ESL

Shepard, Francis P. *See* Andrews, James E. 01138

08748 **Sheppard, R. A.; Walker, G. W.** Potassium feldspar, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 231-28-230, illus., 1969.

Bedded deposits of potassium feldspar are found at several locations in Oregon. Most of these deposits are in tuffs or tuffaceous sediments where potassium feldspar formed as a result of reaction between zeolites and fluids after the rocks were deposited. The extent of reserves and resources of these deposits is not known, but some may have commercial potential in the glass and ceramic industries or possibly as a source of potash for fertilizer. — MHM

08754 **Sheppard, R. A.; Walker, G. W.** Zeolites, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 268-272, illus., table, 1969.

Bedded zeolite deposits occur in Cenozoic continental tuffs and tuffaceous sedimentary rocks in central and southeastern Oregon. None of these deposits have been commercially exploited. The bedded zeolites are a potential resource, but study to determine size and value depends on further development and establishment of suitable markets. — MHM

08596 **Sheridan, Michael F.; Stuckless, John S.** Basanite lava from the Black Mesa cauldron complex, Superstition Mountains, Arizona [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 38, 1969.

08584 **Sherwin, Robert Winslow, Jr.** Morphologic units and vegetation associations of Laguna [Sargento] [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 27, 1969.

Shields, Robert W. *See* Sweeney, James W. 08510

Shillibeer, H. A. *See* Kennedy, K. F. 08604

Shimer, S. S. *See* Vallier, Tracy L. 01110

Shipek, C. J. *See* Marlow, M. S. 01376

01170 **Short, Nicholas M.** Anatomy of a meteorite impact crater — West Hawk Lake, Manitoba, Canada: Geol. Soc. America Bull., v. 81, no. 3, p. 609-648, illus., tables, 1970.

West Hawk Lake submerges an ancient meteorite crater that has been penetrated by drill holes near its center and near the rim. Petrographic study of core from these holes reveals: (1) the target rock consists of steeply dipping metasediments and volcanics, (2) microscopic shock features include planar features in quartz, isotropization of tectosilicates, and devitrified glass, (3) vertical distribution of shock features is erratic, (4) autobrecciation and cataclastic fragmentation are prominent features, (5) zoisite, calcite, antigorite, and zeolites developed after brecciation, (6) analytic techniques indicate significant changes in crystal structure. — RGY

08499 **Simpson, Dale R.** Partitioning of fluoride between solution and apatite: Am. Mineralogist, v. 54, nos. 11-12, p. 1711-1719, illus., tables, 1969.

The fluoride content of phosphorites and marine waters indicates that there is a strong partitioning of fluoride in favor of apatite. However, synthesis of fluorapatite at low temperatures requires solutions enriched 10^2 to 10^3 in fluoride relative to sea water. Uptake of fluoride by sodium-bearing hydroxylapatite reqires similarly enriched solutions, and with the uptake there is a concomitant release of sodium and phosphate from the crystals. Agitation of Durango, Mexico, fluorapatite with water resulted in fluoride increasing to a pF of about 3 and hydroxyl to pOH about 4.5. The surface layer retards the exchange of hydroxyl and fluoride in apatite. — Author's abstract

01260 **Sinha, Ajit K.** Theoretical studies on the rotary field electromagnetic method of prospecting: Geophysics, v. 35, no. 2, p. 310-330, illus., 1970.

The electromagnetic response of a sphere and of a two-layer conducting earth placed in a rotating electromagnetic field is considered. A rotating electromagnetic field is

generated by passing a-c currents of equal strength and frequency that are out of phase by 90° through two identical, orthogonal coils, one horizontal and the other vertical. The resultant elliptically polarized primary field, whose ellipticity is a function of the spatial location, has advantages over the linearly polarized field ordinarily employed in the slingram method of airborne electromagnetic prospecting. The principal advantages of the rotary field method make it possible to measure the "pure anomaly," and to use much greater transmitter-receiver separation than in conventional methods. Main disadvantages are noise and in inability to map closely spaced anomalous beds. — *from* Author's abstract

Skinner, E. L. *See* Cotter, R. D. 08765

01162 **Slabaugh, W. H.** Clay colloids: Chemistry, v. 43, no. 4, p. 8-12, illus., 1970.

Clays of the montmorillonite type seem to dissolve in water, but actually form a dispersion or sol. Optical effects produced by a sol are described. Structure and colloidal properties of clay minerals are discussed. In organo-clays, the exchangeable ion site is filled by an organic cation, and the colloidal properties are very different. The colloidal behavior of clays makes them useful for lining ditches, drilling wells, and in cosmetics and paints; they are also used as a catalyst in petroleum refining. — ESL

08781 **Slemmons, David B.** New methods of studying regional seismicity and surface faulting [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 397-398, illus., 1969.

This study outlines the application of special aerial photography using low angle sun illumination for the study of surface faulting. This method is useful in determining both long-term regional seismicity and rate and nature of faulting for a given area. — KAF

01104 **Smith, Charles L.; McClurg, James E.; Greene, John F.** Open-scheduled laboratory teaching in geology at the University of Michigan — An evaluation [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 405-406, 1970.

01350 **Smith, Judith Terry.** Taxonomy, distribution, and phylogeny of the cymatiid gastropods *Argobuccinum*, *Fusitriton*, *Mediargo*, and *Priene*: Bulls. Am. Paleontology, v. 56, no. 254, p. 445-573, illus., 1970.

Of 45 related and convergent forms described in these genera, 20 are recognized as distinct taxa. Morphologic differences are considered in the light of growth changes, intraspecific variability, and mode of preservation. Ecologic and distributional changes are summarized. Dispersal routes throughout the world for these genera are somewhat tentative owing to insufficient fossil evidence from critical equatorial locations and incomplete knowledge of the Tertiary records in the western Pacific. Data on the free-swimming veliger larva of *Fusitriton oregonensis* and other cymatiid species favor a dispersal by currents, and crossing of the equator as benthic adults rather than as larvae. — *from* Author's abstract

01330 **Smith, Michael Oglesby.** The first Devonian cystoid from Tennessee, *Tetracystis* sp. from the Birdsong Shale [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s24, 1970.

Smith, P. J. *See* Marlow, M. S. 01376

01208 **Smith, R. L.; Bailey, R. A.; Ross, C. S.** Geologic map of the Jemez Mountains, New Mexico: U.S. Geol. Survey Misc. Geol. Inv. Map I-571, scale 1:125,000, sections, 1970.

08571 **Smith, Robert B.** Regional gravity studies of western and central Montana, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 533-534, illus., 1969.

During the summer and fall of 1963 a survey was made establishing 2700 gravity stations and an associated base station network in the general area from 106° W to 115° W and from 45° N to 49° N. The principal objectives of this work were to determine the feasibility of using combined geodetic study and gravity data to evaluate gravimetric interpolation of astrogeodetic deflections of the vertical, and to determine the accuracy of astronomical positions corrected for gravimetrically interpolated astrogeodetic deflections of the vertical. These stations, combined with 1,050 stations obtained by the Air Force, have been used in preparation of Bouguer and residual gravity anomaly maps. Field operations and analysis are discussed, also Bouguer and residual gravity anomalies; a figure shows the Bouguer gravity anomaly map of western and central Montana drawn on a generalized tectonic base map. — GV

08573 **Smithson, Scott B.** Gravity measurements in Wyoming and central Colorado, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 537-538, 1969.

Gravity surveys have been made by University of Wyoming personnel of the Laramie Mountains, Medicine Bow Mountains, Hanna Basin, and South Pass area of Wyoming and the mountainous area west of Aspen, Colorado. In the Laramie Mountains, detailed gravity surveys on spacing as close as 1/2 to 1 km have been conducted in the Precambrian core between lat 41° to 42° N. and long 105°00′ to 105°40′ W. A regional gravity survey of the Hanna Basin, one of the largest negative gravity anomalies in Wyoming, has just been completed between lat 41°30′ to 42°10′ N. and long 106°20′ to 106°40′ W. In west-central Colorado, regional gravity measurements cover the area between Glenwood Springs, Aspen, and Gunnison, from lat 38°30′ to 39°35′ N. and long 106°30′ to 107°30′ W. The Bouguer anomalies in each area are discussed. — GV

08717 **Snavely, P. D., Jr.; Wagner, H. C.; MacLeod, N. S.** Geology of western Oregon north of the Klamath Mountains, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 32-46, illus., table, 1969.

The area of the Coast Range and the Willamette Valley was part of a deep north-trending trough during early Tertiary time. Tertiary rocks of the area are made up of interlayered marine and continental sediments and volcanics and mafic intrusives. Quaternary time is represented by deposits of decomposed gravels, alluvium, and beach and dune sands. — MHM

08649 **Snavely, Parke D., Jr.; MacLeod, Norman S.; Rau, Weldon W.** Geology of the Newport area, Oregon — Field trip guidebook, Geol. Soc. America, Cordilleran Sec., 65th Ann. Mtg., Eugene, Oreg., 1969, Pt. 1: Ore Bin, v. 31, no. 2, p. 25-48, illus., tables, 1969.

The Newport area provides one of the thickest and most complete sequences of Tertiary sedimentary and volcanic rocks. This sequence contains units that are correlative with similar rocks elsewhere in the Coast Range; several formational units are informally named. Lists of selected foraminiferal species, not available elsewhere, are presented. In early to middle late Eocene time this area lay in an elongate marine trough, later deformed to several smaller interconnected basins. The Siletz River Volcanics are the oldest exposed rocks. Ten overlying Tertiary formations are described. Quaternary unconsolidated mud, silt, sand, and gravel blanket most of the coastal area, and several wave-cut terraces are developed. Several suites of igneous rocks intrude the Tertiary in the center of the Coast Range. — ESL

08837 **Southwick, David L.** Crystalline rocks of Harford County, *in* The geology of Harford County, Maryland: Baltimore, Md., Maryland Geol. Survey, p. 1-76, 113-122, illus., tables, geol. maps, 1969.

This report describes geology as found in a new cooperative mapping program with the U.S. Geological Survey in the Piedmont portion of Harford County. Structural setting includes the Baltimore-Washington anticlinorium, Peach Bottom syncline, Tucquan arch, apparent faults, and small scale features. Southeastern

metamorphosed plutonic and volcanic rocks range from greenschist to amphibolite facies; northwestern metamorphosed sedimentary rocks are fine chlorite-albite-muscovite schists to coarse sillimanite-kyanite schists. Descriptions, with analytical tables, include lithology, petrology, and age of Precambrian to Ordovician formations, from Baltimore Gneiss through Peach Bottom Slate, volcanic and intrusive gabbroic complexes, granitic gneisses, and Triassic dikes. Chronology is summarized. Several sketch maps are in pocket with the County geologic map CGM-1 (Southwick and Owens, 1968). — GDC

Sowayan, A. R. *See* McGinnis, L. D. 01084

01351 **Sparling, Dale R.** The Bass Islands Formation in its type region: Ohio Jour. Sci., v. 70, no. 1, p. 1-33, illus., 1970.

The Bass Islands Formation is here considered a formation, divisible, in the type region, into four members. The formation is a hypersaline facies, disconformably overlies the Lockport Dolomite, and is separated from the overlying Amherstburg Dolomite by the Tippecanoe-Kaskaskia unconformity. The lower, Greenfield Member is a dolomite 110 feet thick; the overlying Tymochtee Member comprises 560 feet of dolomite, evaporites, and shale; the next overlying members are the Put-In-Bay and Raisin River Members which disconformably overlie the Tymochtee and are distinguished from each other by the amount of brecciation, the former having more. The paleogeographic setting and association with penesaline facies suggests that most carbonates of the formation have been dolomitized by seepage refluxion prior to final lithification. — HRC

01259 **Spector, A.; Grant, F. S.** Statistical models for interpreting aeromagnetic data: Geophysics, v. 35, no. 2, p. 293-302, illus., 1970.

A mathematical basis for the application of power spectrum analysis to aeromagnetic map interpretation is developed. An ensemble of blocks of varying depth, width, thickness, and magnetization is considered as a statistical model. With the use of the fundamental postulate of statistical mechanics, a formula which can be used to analyze the power spectrum of an aeromagnetic map is developed. The influences of horizontal size, depth, thickness, and depth extent of the blocks on the shape of the power spectrum are assessed. Examples which include power spectrums of maps from Canada and Central America demonstrate the application of the approach. In the cases studied a double ensemble of blocks appears to best explain the observed power spectrum characteristics. — Authors' abstract

Spiker, Elliott. *See* Sullivan, Beverly Marsters. 01382

Srivastava, G. S. *See* Ondrick, C. W. 01362

Stanton, Robert J., Jr. *See* Dodd, J. Robert. 01069

Stelck, C. R. *See* Warren, P. S. 08846

01331 **Stephenson, Richard A.** Channel response on the upper Hiawassee River [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s24-s25, 1970.

08441 **Stetson, T. R.; Uchupi, Elazar; Milliman, J. D.** Surface and subsurface morphology of two small areas of the Blake Plateau, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 131-142, illus., 1969.

A detailed seismic profiler, bottom sampling, and bottom photographic study reveals the surface and subsurface morphology of two small areas on the Blake Plateau. The northern area, a N-S trending depression, is near the continental slope, and the southern is defined by a narrow NE-SW linear depression. Both features are erosional in origin, with subsurface strata cropping out on the sides. The N-S depression is flanked by biohermal coral banks that have developed above the flat underlying strata. Sediments in the vicinity of the banks are dominated by coral fragments, particularly *Dendrophyllia*. With increasing distance from the banks, sediments become

primarily globigerina sand and ooze, with varying amounts of pteropods. Distinctive sediment components in the southern depression are manganese and phosphorite slabs and nodules; coral banks and sediment are practically absent. — *from* Authors' abstract

01227 **Stevens, Dale John.** The high Uintas — A landform analysis [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3703B-3704B, 1970.

08842 **Stewart, John C.** The Earth's past — Laboratory exercises in historical geology: Minneapolis, Minn., Burgess Publishing Co., 153 p., illus., 1968 [1969].

This laboratory manual emphasizes fundamentals of the subject and is general geographically so it can be used in any locality. It is presumed that the student has taken a course in physical geology or earth science. The manual is divided into three parts: fossils and fossilization, interpreting the rock record, and regional geology of the United States. The first two parts may be studied in either order, or the first part may be studied at the end of the term. — MCM

Stewart, Wilson N. *See* Ramanujam, C. G. K. 08767

01105 **Stitt, James H.** Cambrian biostratigraphy, Wichita and Arbuckle Mountains, Oklahoma [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 406, 1970.

01338 **Stuckenrath, Robert, Jr.; Mielke, James E.** Smithsonian Institution radiocarbon measurements VI: Radiocarbon, v. 12, no. 1, p. 193-204, 1970.

This list includes those analyses completed December 1968 on archeologic samples from the United States, South America, Africa, and the Far East; and on geologic and paleontologic samples from the United States and Argentina. — MCM

Stuckless, John S. *See* Sheridan, Michael F. 08596

08506 **Sturgul, J. R.** Analysis of solutions to potential equations, *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 33-46, illus., 1969.

Two problems which are common to nearly every branch of applied physics, including geophysics, are the 'Dirichlet Problem' and the 'Poisson Problem.' A numerical method for their solution is derived and a problem of heat flow in a plate is solved using a high-speed digital computer. The solution to this problem is presented in a form which illustrates the versatility of computer output. — Author's abstract

Suhr, Norman H. *See* Bell, Maurice E. 08693

01382 **Sullivan, Beverly Marsters; Spiker, Elliott; Rubin, Meyer.** U.S. Geological Survey radiocarbon dates XI: Radiocarbon, v. 12, no. 1, p. 319-334, 1970.

This list contains results of measurements made during 1967 and 1968 on samples from the United States, Alaska, Colombia, Austria, and Liberia. — MCM

08599 **Sumner, J. S.; West, R. E.** The University of Arizona's gravity survey program, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 541-542, illus, 1969.

Since the last report, made in 1965 to the AGN, master's and doctoral theses have been completed on the Tucson area, in the Tucson basin and near Nogales in the Ruby quadrangle. Other academic gravity survey work is underway in the Avra Valley immediately west of Tucson, in Walnut Gulch near Tombstone, in the Sulfur Springs and San Pedro Valleys, in the vicinity of the Tonto Forest Seismological Observatory near Payson, and in the Flagstaff area. A figure is given showing the areal coverage completed by the University of Arizona. Planning has started on compilation of an Arizona 1:500,000-scale gravity map to accompany the state geologic and magnetic maps. Methods of data acquisition and interpretation are discussed. — GV

08484 **Supko, Peter R.** Diagenetic patterns in subsurface Bahaman rocks, San Salvador Island [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 504, 1969.

01244 **Suppe, John Edward.** Franciscan geology of the Leech Lake Mountain-Anthony Peak region, northeastern Coast Ranges, California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3713B, 1970.

08674 **Sverdrup, Leif J.** Constructing Chesapeake Bay bridge-tunnel [summ.]: Tunnels and Tunneling, v. 1, no. 4, p. 183-186, illus., 1969.

This 17 1/2-mile road link across the mouth of Chesapeake Bay, in southeastern Virginia, is unique as an example of a bridge-tunnel crossing. Relevant to a proposed British Channel Tunnel, the author reports salient points of a paper he presented in London. Variable subsurface conditions included submerged Pleistocene stream channels and rock some 2,000 feet down, in a heavy shipping lane exposed to the full force of the Atlantic Ocean and its storms. Upon the channel fills of various combinations of sediments was a generally uniform compressible layer of peat. Lack of this peat on the southeast corner of North Thimble Shoal Island presented a construction problem for a ventilation building and shaft. To avoid differential settlement, extra sand surcharges were placed there and removed several months later after the island had settled 6 to 8 feet; subsequent settlement has amounted to a total of several inches at a decreasing rate. — GDC

08560 **Swanson, Donald A.** Reconnaissance geologic map of the east half of the Bend quadrangle, Crook, Wheeler, Jefferson, Wasco and Deschutes Counties, Oregon: U.S. Geol. Survey Misc. Geol. Inv. Map I-568, scale 1:250,000, sections, 1969.

08510 **Sweeney, James W.; Addison, Charles H.; Shields, Robert W.** GIPSY — Possible uses of a generalized information processing system in mining, *in* A decade of digital computing in the mineral industry (Alfred Weiss, editor): New York, Am. Inst. Mining, Metall., and Petroleum Engineers, p. 305-309, 1969.

GIPSY is user oriented, is flexible in applications, is an iterative question answering system, has an adaptable retrieval mechanism, has both a batch and a teleprocessing version, allows the user to "browse" through his information, has ability to answer "ad hoc" queries, and is a currently working and proven system. — Authors' abstract

Sweet, Walter C. *See* Bergström, Stig M. 01054

Sweet, William E., Jr. *See* Bouma, Arnold H. 08444

01377 **Swift, Donald J. P.** Quaternary shelves and the return to grade: Marine Geology, v. 8, no. 1, p. 5-30, illus., 1970.

Shelves with relict sediments and relict morphology result when the sediment transport net has been disrupted by a sea-level rise which is rapid relative to rate of sediment supply. Consideration of modern and ancient shelf deposits suggests that following such a rise a sequence of partially graded stages may ensue, which is terminated by the climax graded shelf. A first stage appears to be in situ grading, where central shelf sediments of relict origin become equilibrium sediments in terms of texture. In this stage, the nearshore lens of modern sediments is at least in part derived by winnowing of relict central shelf sediments. A second stage begins when estuaries bypass suspended fines in amounts adequate to generate seaward prograding blankets of mud. Climax occurs when sand as well as mud is bypassed and fine sand spreads to all parts of the shelf. — *from* Author's summary

08555 **Sykes, C. Ronald.** Mineral resources summary of the Yuma quadrangle, Tennessee: Nashville, Tenn., Tennessee Div. Geology, 9 p., tables, 1969.

This text accompanies Tennessee Div. Geology Geol. Map GM 10-SE by D. L. Brown (cited separately) and describes the sand (only mined resource in the Yuma quadrangle) which is abundant in fluvial deposits and in the Clayton and McNairy Formations. Although used primarily for road fill, some of the relatively iron-free

material is mined for construction purposes. Potential resources are clay and heavy minerals. — MCM

Sykes, Lynn R. *See* Molnar, Peter. 01298

08780 **Sykes, Lynn R.; Oliver, Jack; Isacks, Bryan L.** Seismology and the new global tectonics—Implications for earthquake prediction [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 397, 1969.

This is a summary of a paper by Bryan L. Isacks, Jack Oliver, and Lynn R. Sykes published in Jour. Geophys. Research, v. 73, p. 5855-5859, 1968. *See* Abstracts of North American Geology for March 1969. — KAF

Syrstad, Oddvelg. *See* Nydal, Reider. 01337

01106 **Szucs, F. K.** The hierarchical anomaly of the Au Sable and Saginaw drainage basins, Michigan [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 406-407, 1970.

01283 **Tackett, Stanford L.; Tucker, Ray A.; Duncan, Floyd R.** Electrolytic corrosion of iron meteorites: Meteoritics, v. 5, no. 1, p. 43-55, illus., tables, 1970.

Six iron meteorites were electrolyzed and the resulting corrosion was studied by a potentiostatic technique. It was found that both iron and nickel in the kamacite phase dissolve, and that neither iron nor nickel dissolves from taenite. The rate of corrosion was shown to be inversely proportional to the nickel content. However, structure, as well as nickel content, plays an important part in the electrolytic process. The Coya Norte, Chile meteorite dissolved more rapidly and more easily (at a lower potential) than did pure iron even though the Coya Norte meteorite contains 5.5 percent nickel. — Authors' abstract

Tedrick, P. A. *See* Griffin, G. M. 08526

01108 **Teeter, James W.** Paleoecology of a Pleistocene microfossil assemblage at the Fairlawn, Ohio mastodon site [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 407, 1970.

08679 **Téllez, C.; deAlvarez, G.; Malpica Cruz, R.** Microfacies de algunas formaciones paleozoicas del norte de México [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 90, 1969.

01314 **Tesone, V. P.** Twenty-three rigs seek Muddy sand pay in one Wyoming field: World Oil, v. 170, no. 5, p. 87-88, 92, 95, illus., table, 1970.

Drilling is at a peak in Hilight field of northwestern Wyoming's Powder River basin. Production is from north-south trending marine offshore bar sand deposits indicating a "stillstand" during an easterly transgression of the sea in Lower Cretaceous Muddy time. Four separate bars have been identified. — GHD

01179 **Textoris, Daniel A.; Dennison, John M.** Petrology of Devonian Tioga Bentonite [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 243-244, 1970.

08721 **Thayer, T. P.; Wagner, N. S.** Geology of the Blue Mountain region, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 68-74, illus., 1969.

The Blue Mountains are a complex of mountain ranges and intermontane basins and valleys in northeastern Oregon. Pre-Tertiary volcanic and sedimentary units, deposited mostly under marine conditions, were intruded by at least two groups of plutonic rocks, and have been strongly deformed and variably metamorphosed. Tertiary and younger formations consist principally of continental volcanic rocks and erosional debris derived from them and pre-Tertiary rocks. Mineral resources of the area include gold, silver, chromite, asbestos, various volcanic rocks, diatomite,

gypsite, and clays. Copper, cobalt, molybdenite, scheelite, manganese, stibnite, and quicksilver form deposits of economic interest. — MHM

08729 **Thayer, T. P.; Ramp, Len.** Chromite, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 108-116, illus., table, 1969.

Podiform deposits of chromite occur in ultramafic rocks in the Klamath Mountains of southwestern Oregon and in Canyon Mountain and the Fields Creek-Deer Creek belt in the northeastern part of the State. Chromiferous black sands occur in present beaches and on raised marine terraces in Coos and Curry Counties. In 1956 the chromium resources of Oregon were estimated to be about 350,000 long tons of Cr_2O_3. — MHM

01147 **Thompson, Allan M.** Lithofacies and formation nomenclature in Upper Ordovician stratigraphy, central Appalachians: Geol. Soc. America Bull., v. 81, no. 4, p. 1255-1260, illus., 1970.

The Upper Ordovician of the central Appalachians may be subdivided into (1) three formations (Reedsville, Bald Eagle, and Juniata) based largely on rock color, and (2) six clastic lithofacies, based on lithology only. The two methods of subdivision frequently disagree, and lithofacies are often contained in different formations. This phenomenon is caused by a nonsystematically fluctuating drab-red color boundary; areally, the drab Bald Eagle Formation is of irregularly variable thickness. Fossiliferous lithofacies constitute the Reedsville Formation, drab unfossiliferous lithofacies constitute the Bald Eagle Formation, and red unfossiliferous lithofacies make up the Juniata Formation. — Author's abstract

01361 **Thompson, Thomas L.; Fellows, L. D.** Stratigraphy and conodont biostratigraphy of Kinderhookian and Osagean (Lower Mississippian) rocks of southwestern Missouri and adjacent areas: Missouri Geol. Survey and Water Resources Rept. Inv. 45, 263 p., table 1969 [1970].

Kinderhook and Osage Series formations that outcrop on the flank of the Ozark uplift are described; 42 sections were sampled in order to determine lithobiostratigraphic correlations. Of 26,250 conodonts recovered, there were 52 species of 13 genera, 2 new subspecies, and 2 uncertain forms. *Gnathus punctatus*, younger than any known Kinderhookian form in the Mississippi Valley, recovered with *Siphonodella cooper hassi* n. ssp., marks the Kinderhookian-Osagean boundary. The basal Bachelor Formation was deposited upon eroded Ordovician to Devonian strata; next younger units show little lateral change and slight erosion. Osagean sediment first spread rapidly northward; overlying formations, youngest southwestward, represent a massive complex; some are very cherty equivalents of the crinoidal Burlington-Keokuk sequence. Farthest south, age-equivalent St. Joe Limestone is only a foot or two thick. — GDC

Thrailkill, John. *See* Johnson, John T. 01176

01202 **Tien, Pei-lin; Waugh, Truman C.** Epsomite and hexahydrite from an underground storage area, Atchison, Kansas, *in* Short papers in research in 1969: Kansas Geol. Survey Bull. 199, pt. 1, p. 3-7, illus., tables, 1970.

Epsomite and hexahydrite occur on the walls, pillars, and ceilings of an underground storage area in the Plattsmouth Limestone Member (late Pennsylvanian). These minerals are confirmed by X-ray diffraction analysis. Pure epsomite is found in an area of low temperature (14-16°C) and high relative humidity (90-91 percent). Hexahydrite is found in an area of higher temperature (20-24°C) and lower relative humidity (38-40 percent). Both field and laboratory evidence indicates that hexahydrite is formed by dehydration of epsomite, which is not stable under laboratory conditions (temperature above 20°C, R.H. below 70 percent). To the authors' knowledge, this is the first reported occurrence of hexahydrite from Kansas. — Authors' abstract

01140 **Tillman, C. G.** Metamorphosed trilobites from Arvonia, Virginia: Geol. Soc. America Bull., v. 81, no. 4, p. 1189-1199, illus., 1970.

All known trilobites from the metamorphic Arvonia Slate, Arvonia, Virginia, are described and illustrated. Eleven trilobite individuals are represented. The fauna includes one individual referred to the Order Ptychopariida, one to the Family Proetidae(?), four to the Sub-family Calymeninae, one to the genus *Gravicalymene*(?), one to the Family Calymenidae(?), one to the Family Pterygometopidae, and two to Order Undetermined. The age suggested by these trilobites is Middle or Late Ordovician. This is consistent with previous determinations which were based on the whole fauna. — Author's abstract

08777 **Tocher, Don.** Fault creep in central California [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 385, 1969.

08620 **Toledo Toledo, M.** Problemas de exploración de la Plataforma Continental de la Zona Norte [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 81, 1969.

08469 **Toulmin, Lyman D.** Paleocene and Eocene guide fossils of the eastern Gulf Coast region, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 465-487, illus., tables, 1969.

Mollusks and irregular echinoids are useful in the eastern Gulf Coast region as indicators of stratigraphic position. Diagnostic species and distinctive assemblages of megafossils easily recognizable to geologists with limited knowledge of paleontology, are common in fossiliferous beds spaced at close stratigraphic intervals through the Paleocene and Eocene sequence. The most common, easily identified, widespread, and stratigraphically restricted are species of Ostreidae, *Venericardia*, Pectinidae, Crassatellidae, and irregular echinoids. The most useful species that have been selected for the names of sixteen assemblage and range zones distributed through the Paleocene and Eocene Series in the eastern Gulf Coastal Plain region are summarized here. — *from* Author's abstract

01332 **Trimble, Stanley W.** Culturally accelerated sedimentation on the Middle Georgia Piedmont [abs.]: Georgia Acad. Sci. Bull., v. 28, no. 2, p. s25, 1970.

01225 **Tsai, Nien Chien.** Influence of local geology on earthquake ground motion [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3635B, 1970.

Tucker, Ray A. *See* Tackett, Stanford L. 01283

Uchupi, Elazar. *See* Stetson, T. R. 08441

Uhlmann, D. R. *See* Calvert, Paul. 08502

U.S. Bureau of Mines. *See* U.S. Geological Survey. 08715

U.S. Bureau Reclamation. *See* U.S. Geological Survey. 08715

01153 **U.S. Geological Survey; U.S. National Park Service.** The river and the rocks — The geologic story of Great Falls and the Potomac River Gorge: Washington, D. C., U.S. Govt. Printing Office, 46 p., illus., 1970.

A brief account is given of the geology of Great Falls, summarizing known events that formed the rocks and shaped the land. During Precambrian the Baltimore Gneiss was formed, followed by Cambrian(?) deposition of sedimentary rocks, chiefly shale and sandstone. The Paleozoic era also included metamorphism and folding of older sedimentary rocks, intrusion of granite and lamprophyre dikes, and finally uplift of the Appalachian Mountains. The Triassic is represented by sedimentary rocks deposited in Leesburg Basin and Frederick Valley, and the Cretaceous-Tertiary by sediments on the Atlantic Coastal Plain. Carving of the Potomac Valley occurred during Quaternary. Rock information is tabulated, showing name, description, color, and original rock. Trail logs are included. — MCM

01262 **U.S. Geological Survey.** Ground-water levels in the United States, 1963-67 — Northeastern states: U.S. Geol. Survey Water-Supply Paper 1977, 238 p., illus., tables, 1970.

Records of water levels from 1963-67 are given for Connecticut, Delaware, Indiana, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, and Vermont. — MCM

08715 **U.S. Geological Survey; Oregon Dept. Geology, Min. Industries; U.S. Bureau Reclamation; Bonneville Power Administration; U.S. Bureau of Mines.** Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, 462 p., illus., tables, geol. map, 1969.

Introductory chapters summarize the geology and physiography of Oregon and the geologic setting of each of the geomorphic provinces of the State. Succeeding chapters contain detailed information about each mineral commodity known to occur in the State. Section II of the report pertains to the water resources and development in the State and within principal drainage basins. Individual papers are cited separately. — MHM

U.S. National Park Service. *See* U.S. Geological Survey. 01153

Utgaard, John. *See* Fraunfelter, G. H. 01215

01340 **Valastro, S., Jr.; Davis, E. Mott.** University of Texas at Austin radiocarbon dates VII: Radiocarbon, v. 12, no. 1, p. 249-280, 1970.

This list reports C-14 measurements made in dating projects completed in the year ending December 1968, and some for projects still in progress on: check samples from Texas and Wisconsin; geologic and oceanographic samples from Mexico, Jamaica, and Texas; paleobotanical samples from Texas; and archeologic samples from Texas, Oklahoma, Arkansas, Louisiana, Utah, Mexico, Peru, and Korea. — MCM

08670 **Valentine, James W.** Patterns of taxonomic and ecological structure of the shelf benthos during Phanerozoic time: Palaeontology, v. 12, pt. 4, p. 684-709, illus., 1969.

The taxonomic and ecological structure of the shelf biota are intimately related at the species-population levels. Early Paleozoic faunas contained relatively few species representing relatively many higher taxas, and ecosystems were relatively generalized. Medial and late Paleozoic faunas contained more species representing fewer higher taxa, and ecosystems were relatively specialized. This suggests that, as higher taxa became extinct, they were not replaced except at lower taxonomic levels; diversification was proceeding through increasing specialization. After Permo-Triassic extinctions, rediversification was chiefly confined to lower taxonomic levels. Late Mesozoic and Cenozoic diversification at lower taxonomic levels has been remarkably great. —*from* Author's abstract

08568 **Valliant, H. D.** Gravity measurements in western North America with the Canadian pendulum apparatus, *in* Symposium on gravity surveys in western North America (David F. Barnes, editor): EOS, v. 50, no. 10, p. 525-526, table, 1969.

Improvements on the Dominion Observatory's pendulum apparatus are discussed. A table is given summarizing gravity measurements made with the instrument along the North American Calibration Line at College, Alaska; Edmonton, Alberta; Denver, Colorado; and Mexico, D. F. The Canadian pendulum apparatus is currently being employed to establish a pendulum control network throughout Canada. — GV

01109 **Vallier, Tracy L.** Deep Sea Drilling Project — An opportunity for student involvement in current oceanographic research [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 408, 1970.

01110 **Vallier, Tracy L.; Waldrip, James; Shimer, S. S.** Granitic clasts in Upper Triassic conglomerates, Snake River Canyon, Oregon and Idaho [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 408, 1970.

08610 **VanLoon, J. C.; Parissis, C. M.** Scheme of silicate analysis based on the lithium metaborate fusion followed by atomic-absorption spectrophotometry: Analyst, v. 94, no. 1125, p. 1057-1062, tables, 1969.

A procedure and results are given for the determination of Si, Al, Ti, Fe, Ca, Mg, K, Na and Mn in twelve standard silicate rocks of widely varying compositions. A comprehensive study has been made of potential interferences in order that the method should be applicable over a wide range of sample compositions. The lithium metaborate-nitric acid dissolution system is used to enable previously developed colorimetric and spectrographic procedures with similar parting solutions to be used for determining important silicate constituents that cannot be determined directly by atomic absorption. — Authors' abstract

08678 **Velarde Nuñez, P.** Posibilidades petrolíferas de las formaciones Mesozóicas en la Cuenca de Veracruz [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 86, 1969.

08648 **Velasco Arellano, Abraham.** Estudio geológico del área Huizache-Vallejo, Municipios de Villa Hidalgo, Villa de Guadalupe y Guadalcázar, S.L.P.: Geología y Metalurgia, v. 4, no. 28, p. 22-46, illus., geol. map, 1969.

The study of the natural resources of the Huizache-Vallejo area was done by the Instituto de Geología y Metalurgia of the Universidad Autónoma de San Luis Potosí, with special emphasis on the desert and semidesert regions. Based on interpretation of aerial photos and field work, a geologic map on a scale of 1:30,000 was completed. The study includes a general background on natural history, economics and culture. The Lower Cretaceous marine El Doctor limestone formation predominates in the area. Igneous rocks are represented by Tertiary basalts and rhyolite dikes and by a cone of igneous intrusive rock classified as tonalite. Quaternary alluvial deposits cover about 60 percent of the area. The only mineral of economic importance is celestite which occurs in several places; one deposit has 40.8 percent strontium content. Ground water is generally mineralized. — EH

08632 **Verdugo V., R.** Posibilidades petrolíferos de las formaciones del Oligoceno y Mioceno en la Cuenca de Veracruz [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 85, 1969.

08730 **Vhay, J. S.** Cobalt, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 116-120, illus., 1969.

Cobaltiferous deposits of Oregon occur in segregated sulfides in ultramafic sills; in hydrothermal copper deposits in serpentine; in nickeliferous laterites; and in hydrothermal veins with gold, copper, and cobalt near a quartz diorite intrusion. Cobalt-bearing nickeliferous laterites in southwestern Oregon are sub-marginal under present economic conditions. — MHM

Vincent, Edith. *See* Bandy, Orville L. 08647

01344 **Vine, F. J.** Sea-floor spreading and continental drift: Jour. Geol. Education, v. 18, no. 2, p. 87-90, illus., tables, 1970.

Vine summarizes developments and ideas concerning sea-floor spreading and continental drift not covered in his previous review of 1969 in this journal. He includes a time-table for continental drift and a map of the Pacific Ocean, showing Cenozoic crustal spreading and age of anomalies, and emphasizes the significance of sea-floor spreading, continental drift and plate tectonics in earth science education as fundamental to all aspects of the science. — EH

08638 **Viniegra O., F.** Nuevas provincias [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 89, 1969.

Vinot, A. C. *See* Duplessy, J. C. 01289

01154 **Visocky, Adrian P.** Estimating the ground-water contribution to storm runoff by the electrical conductance method: Ground Water, v. 8, no. 2, p. 5-10, illus., 1970.

Ground-water contribution can be estimated if stream flow and conductance of surface water and of ground water are known. The conductance method was tested on [the Panther Creek] basin in north-central Illinois. Continuous records of stream flow, stream-flow conductance, and ground-water stage within the basin were collected. A rating curve of base flow vs. mean ground-water stage was constructed, and ground-water discharges determined from the rating curve were compared with those from conductance data. The conductance method normally gave a lower estimate of ground-water contribution than the rating-curve method, but analyses of storms after long dry periods resulted in much lower estimates of ground-water contribution by the rating-curve method. Conductance offers an alternative for use in areas without observation wells or where rating curves are difficult to construct. — *from* Author's abstract

vonBitter, Peter H. *See* Morency, Maurice. 01204

vonderBorch, C. *See* Peterson, M. N. A. 01371

vonderBorch, C. C. *See* Peterson, M. N. A. 01360

Wagner, H. C. *See* Snavely, P. D., Jr. 08717

08757 **Wagner, H. C.; Newton, V. C., Jr.** Petroleum and natural gas, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 280-298, illus., 1969.

No oil or gas has been produced in Oregon, but there are indications of the presence of petroleum. The Tertiary marine area, that part of the State west of the Cascade Range and north of the Klamath Mountains, probably has the best possibilities for commercial production. — MHM

Wagner, N. S. *See* Thayer, T. P. 08721

08727 **Wagner, N. S.; Ramp, Len.** Antimony, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 93-98, illus., 1969.

In Oregon, antimony commonly occurs as a minor metal in gold veins. The Gray Eagle mine, Baker County, and the Jay Bird mine, Jackson County, produced small but critically needed amounts of antimony during World War II. Deposits valuable mainly for gold and silver with accessory antimony occur in the Bohemia district of Lane County and the Greenhorn district of Grant County. Three other mines that produced some antimony ore are: the Lowry in Jackson County, the Coyote in Malheur County, and the Stibnite in Union County. There are no known measurable ore reserves, but undiscovered prospects may exist, especially in northeastern and southwestern parts of the State. — MHM

08743 **Wagner, N. S.** Borates, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 193-197, illus., 1969.

Borates are not mined in Oregon at present but have been produced at Cape Ferrelo in Curry County and in the Alvord Desert, Harney County. Because California borate reserves will meet industrial needs for the next 100 years, there is little incentive for exploration of new deposits. If or when additional borate reserves are needed, Alvord Basin should be more thoroughly explored. — MHM

08744 **Wagner, N. S.** Diatomite, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 205-210, illus., table, 1969.

There are many diatomite occurrences in Oregon, but only minor quantities of diatomite have been produced in recent years. Most deposits examined are unsuitable for production of high quality filter media but would be suitable for common to intermediate grade uses. The potential for finding minable quantities of filter-grade

diatomite cannot be regarded as wholly negative. The regions of the High Lava Plains, Basin and Range, and Owyhee Upland province are logical areas for further exploration. — MHM

08745 **Wagner, N. S.; Withington, C. F.** Gypsum and anhydrite, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 214-218, illus., 1969.

Between 1896 and 1926 gypsum was produced from deposits near the Snake River in Baker County. The remnants of anhydrite and gypsum at and near the original mine site constitute the only reserves known in this area. A deposit of gypsite in Crook County reportedly was mined to a limited extent in the early 1900's. This material might possible be developed for use as a soil conditioner. No other reserves are known in the State. — MHM

08747 **Wagner, N. S.** Perlite, pumice, pumicite, and cinders, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 222-228, illus., 1969.

There are noteworthy occurrences of perlite, pumice, pumicite, and cinders in Oregon, especially east of the High Cascades. Shipments of lump pumice from Deschutes and Klamath Counties have been made periodically during this century. During the past 20 years, output of pumice and cinder aggregate has grown steadily, and periodic production of perlite, pozzolanic cinders, and pumicite also has increased. Reserves of pumice are large, and minable occurrences of pumicite are known in several areas of the State, and occurrences of pumicite, perlite, and cinders undoubtedly can be found in eastern Oregon. Exploitation will depend on transportation costs and availability of markets, as well as size and quality of deposits. — MHM

08798 **Wagner, N. S.; Ramp, Len.** Asbestos, olivine, and other magnesium silicate minerals, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 187-193, illus., tables, 1969.

Asbestos, olivine, serpentinite, and diopside are associated for the most part with similar rocks and are commonly found in the same general areas. Both chrysotile and amphibole asbestos occur in Oregon, and small amounts of asbestos have been produced. None of the known occurrences are of commercial significance. Olivine has not been produced in Oregon, but dunite and olivine-rich peridotite in southwestern and northeastern Oregon are potential sources. These same areas contain potential serpentinite resources, and large percentages of diopside are contained in pyroxenites in the Whiskey Creek-Oregon Mountain area. — MHM

08799 **Wagner, N. S.** Carbon dioxide, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 197-200, illus., 1969.

At present there is no commercial production of natural carbon dioxide from Oregon. Between 1945 and 1961 a plant near Ashland converted CO_2 to dry ice. Should there be sufficient demand for carbon dioxide in the future several soda-water springs, which are scattered across the State, would appear to warrant further investigation. — MHM

Wagner, Norman S. *See* Ciesiel, Robert F. 08651

Wahrhaftig, Clyde. *See* Wolfe, Jack A. 01313

Waldrip, James. *See* Vallier, Tracy L. 01110

08723 **Walker, G. W.** Geology of the High Lava Plains province, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 77-79, illus., 1969.

The High Lava Plains province, a Cenozoic volcanic upland, extends eastward from the Cascade Range across the structural depression of the Harney Basin, a distance of about 160 miles. The Brothers fault zone of west-trending normal faults dominates the structural pattern of the province. Eruptive centers for Pliocene and Pleistocene basaltic and rhyolitic volcanics are concentrated along the fault zone. This zone may reflect the surface adjustment of rocks overlying a deeply buried fault with lateral displacement. Older Cenozoic volcanic and sedimentary rocks are exposed along northern margin of the High Lava Plains. — MHM

Walker, G. W. *See* Corcoran, R. E. 08724

08725 **Walker, G. W.; Peterson, N. V.** Geology of the Basin and Range province, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 83-88, illus., 1969.

In Oregon the Basin and Range province extends eastward from the Cascades to the eastern limits of the Trout Creek Mountains and from the High Lava Plains southward into California and Nevada. The province is dominated by Cenozoic volcanic rocks broken by two cross-cutting fault sets. Faulting and volcanic activity played important roles in development of structural patterns. Pre-Tertiary rocks are exposed in the Pueblo Mountains and the Trout Creek Mountains. Violent eruption of Mount Mazama about 7,000 years ago resulted in the formation of the basin of Crater Lake. — MHM

Walker, G. W. *See* Sheppard, R. A. 08748

Walker, G. W. *See* Sheppard, R. A. 08754

08676 **Walker, George W.** Geologic map of the Kau Desert quadrangle, Hawaii: U.S. Geol. Survey Geol. Quad. Map GQ-827, scale 1:24,000, section, text, 1969.

The Kau Desert quadrangle is on the southern flanks of Kilauea Volcano, from whose explosive eruptions, fragmental debris has resulted. Residual and discontinuous patches of ash and pumice, lapilli, and lithic and mineral fragments are present; recent eruptions of Kilauea have dusted large sections with Pele's hair, now erratically redistributed. All rocks are of basaltic composition, but considerable variation exists in their mineral and chemical content. Parts of three distinctive zones of fracturing and faulting are present. Map units described are from the Hilina and Puna Volcanic Series (Tertiary(?)-Quaternary and Quaternary, respectively). Cones occur along many of the faults and fractures in the southwest rift and Koae fault zones; basalt dikes are present in the southern section. Surficial deposits are talus, fanglomerate, sheetwash, and ash and sand deposited by wind and water. — MCM

08771 **Wallace, Robert E.** Tectonics of the San Andreas fault system geologic studies [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 378, 1969.

Some results are presented of the geologic studies on earthquake probability, the distribution and patterns of active faults, recent earthquakes (in California and elsewhere), and the San Andreas fault and the continental margin. — DBV

Wallace, Robert J. *See* Peters, Walter G. 01096

Wane, M. T. *See* Barla, G. 01292

08846 **Warren, P. S.; Stelck, C. R.** Early *Neogastroplites*, Fort St. John Group, western Canada: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 529-547, illus., table, 1969.

Neogastroplites cornutus wilderensis new subspecies (Cretaceous) is described; it shows large smooth adult discs concealing tuberculate inner whorls. For comparison, *N. maclearni* Reeside and Cobban from Cadomin, Alberta, is illustrated, and other neogastroplitid ammonites of the region are considered. Occurrences of *Neogastroplites* ssp. within the Goodrich and Sikanni Formations, northeastern British

Columbia, are discussed. A vertical range of about 700 feet here contrasts with the 500 ft range-zone approximated by Reeside and Cobban (1960) in Wyoming. Fish scale sands of the Shaftesbury Formation mark the Lower-Upper Cretaceous boundary; other time-stratigraphic markers include a cone-in-cone bed at 61 feet, and three volcanic tuffs at 300, 380, and 761 feet, respectively, below the overlying Dunvegan Sandstone. Correlations are reviewed, the neogastroplitid succession extended, and corrections suggested. — GDC

Waters, Aaron C. *See* Fisher, Richard V. 01177

08483 **Watkins, N. D.** Virtues and vices of the paleomagnetic method as applied to marine sedimentary cores [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 613, 1969.

Waugh, Truman C. *See* Tien, Pei-lin. 01202

08645 **Weaver, D. W.** The limits of Lyellian Series and Epochs *in* Colloque sur l'Éocene, Paris, 1968, V. 3: [France] Bur. Recherches Géol. et Minières Mém. 69, p. 283-286, 1969.

The Paleogene cannot be further refined on a series-epoch level beyond the threefold subdivision of Lyell (1835), who correlated only bulk stratal and faunal units. Attempts to define series-epochs in terms of the more refined principles of Oppel (1856) (stages and zones), by suggesting changes in series types or abandonment of units (notably the Oligocene), only violate concepts of priority, and appear to be unnecessary. Accuracy and clarity would be enhanced if series-epoch boundary problems were divested of series-epoch terminology and discussed instead within the stage-age or zonal category of refinement required. Chronologies of wide-ranging taxa such as nannoplankton, planktonic and smaller benthonic foraminifers, in association with more provincial taxa such as mollusks, larger foraminifers, and land mammals, are useful for precise interprovincial correlations. — VMJ

08711 **Webb, Robert W.; Norris, Robert M.** Geology of California — Geology XSB 109: Berkeley, Calif., Univ. California, Dept. Correspondence Instruction, 229 p., illus., tables; separate bibliography, 44 p., 1969.

This correspondence course text is composed of articles from various sources, some reproduced in their entirety. No study questions or exercises are included. — MCM

01370 **Webster, D. S.; Proctor, J. F.; Marine, I. W.** Two-well tracer test in fractured crystalline rock: U.S. Geol. Survey Water-Supply Paper 1544-I, p. I1-I22, illus., tables, 1970.

A pulse injection of tritium (300 curies) was made to flow from an injection well to a discharge well through fractures in crystalline rock buried beneath about 1,000 feet of coastal plain sediments at the Savannah River Plant, S. C.; wells were 1,765 feet apart, and duration of the test was 2 years. The concentration of tritium arriving at the discharge well can be duplicated by calculations based on fluid dispersion in a homogeneous medium. In developing the theoretical curve, the only unknown variables were transit time for nondispersed flow along line connecting the two wells, and characteristic dispersion length in the medium (fractured crystalline rock); these two values were obtained by curve fitting. Results of the tracer test agree with computations based on the assumption that flow was through a homogeneous medium consisting of numerous intersecting fractures. — *from* Authors' abstract

01214 **Webster, G. D.; Lane, N. Gary.** Carboniferous echinoderms from the southwestern United States: Jour. Paleontology, v. 44, no. 2, p. 276-296, illus., tables, 1970.

Study of Late Mississippian-Middle Pennsylvanian crinoids and blastoids of Nevada, Arizona, and Utah suggests that they occur in sufficient numbers to be of stratigraphic value in the western U.S. One crinoid, *Paragassizocrinus calyculoides* (Lane) is a good index fossil for upper Morrowan strata in the Great Basin. Two species of the blastoid *Pentremites* are recognized [in Nevada]; one, *P. aridus*, is new. Crinoids

assignable to 19 genera include 14 new species: *Kallimorphocrinus inaquosus, K. inhumectus, Plummericrinus retorridus, Perimestocrinus quintorus, Metaperimestocrinus verrucosus, M. squarrosus, Stenopecrinus pedersenorum, Sciadiocrinus brewi, Scytalocrinus reconditus, Aesiocrinus, inflatus, Endelocrinus solus, Paradelocrinus nederi, Synarmocrinus carrizoensis, Poteriocrinus cavus.* — *from* Author's abstract

08530 **Weeks, L. A.; Lattimore, R. K.; Harbison, R. N.; Bassinger, B. G.; Merrill, G. F.** Structural relationships between Lesser Antilles, Venezuela, and Trinidad-Tobago [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 321, 1969.

08613 **Weichert, D. H.; Whitham, K.** Calibration of the Yellowknife seismic array with first zone explosions: Royal Astron. Soc. Geophys. Jour., v. 18, no. 5, p. 461-476, illus., tables, 1969.

Recordings from a crustal seismic experiment, in the Yellowknife area in 1966, were used for calibration of the Yellowknife seismic array. In the immediate vicinity of the array the crust is found to be very uniform. A superficial layer with an intercept time of 0.172±0.012 sec and unknown velocity is underlain by a crust with a P-wave velocity of 6.04±0.01 km sec^{-1} near the top; assuming the velocity constant throughout the second layer, the total thickness of the crust is about 34±2 km. The Mohorovicic discontinuity is horizontal under the array within the resolution of this experiment and the apparent P_n velocity is 8.15 km sec^{-1}. At a distance of a few tens of kilometers the crustal uniformity breaks down. The distances are such that, for most teleseismic signals, the effect of these inhomogeneities should be negligible. — Authors' summary

08460 **Weidie, A. E.** Tectonics of southern rim of Gulf of Mexico basin [abs.], *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 321, 1969.

08503 **Weiss, Alfred.** (editor). A decade of digital computing in the mineral industry (a review of the state-of-the art), based on the 1969 International Symposium on Computer Applications and Operations Research in the Mineral Industry: New York, Am. Inst. Mining, Metall., and Petroleum Engineers, 952 p., illus., tables, 1969.

This symposium, held in Salt Lake City, Utah, 1969, presents diverse examples of the technical use of computers and operations research in the mineral industry throughout the world. Techniques developed over the past decade generally begin with a problem that needs to be solved, but there is evidence of the opposite approach of starting with computer applications as the solution and looking for problems to fit them. Progress in the field covers a wide spectrum from exploration to marketing, cutting across many of the scientific and engineering disciplines. Of the 47 papers in the symposium, 13 (including 3 abstracts) are cited separately. — MCM

01290 **Weiss, R. F.** Helium isotope effect in solution in water and seawater: Science, v. 168, no. 3928, p. 247-248, table, 1970.

The isotope effect in the solution of helium in water from 0° to 40°C has been determined by microgasometric measurements of the solubilities of pure He-3 and He-4. At 0°C He-3 is less soluble than He-4 in both distilled water and seawater by 1.2 percent. The observed fractionation factor is 0.988 ± 0.002 at 0°C and appears to decrease with increasing temperature at the rate of 0.0001 per °C, although the existence of this trend is of limited statistical certainty. The measured isotope effect is in agreement with the ratio of He-3 to He-4 in surface ocean water reported by Clarke, Beg, and Craig [1969]. — Author's abstract

Weissenborn, A. E. *See* Dole, Hollis M. 08716

08726 **Weissenborn, A. E.; Dole, H. M.** The mineral industry of Oregon, *in* Mineral and water resources of Oregon: U.S. Cong., 90th, 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 89-93, illus., 1969.

Mineral production in Oregon separates into three phases. First, a short, rich period ending about 1874; during this time gold, mainly placer, was the dominant mineral produced. During the second phase lode gold became more important, and production of nonmetallic minerals increased. Mercury production began, and, during World War I, there was a small production of tungsten, antimony, manganese, and some base metals. Chromite mining began during this second phase. The third period, one of vigorous growth that started about 1935, is marked by increased production of construction materials. Gold mining, interrupted by World War II, was discontinued when it ceased to be economic; nickel mining started at Riddle in 1954. — MHM

08603 **Welby, Charles W.** (compiler). Type locality descriptions, *in* Geology of the American Mediterranean: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 615-621, illus., 1969.

Type localities are described for the Penholoway Formation, Pleistocene, Wayne County, Georgia; Cedar Keys Limestone, Paleocene, near Hilliard, Nausau County, Florida; Chipola Formation, Miocene, Calhoun County, Florida; Williston Formation, Eocene, Levy County, Florida; Zilpha Clay, Eocene, Bucksnort Hill, Attala County, Mississippi; Bashi Marl Member of Hatchetigbee Formation, Eocene, northwestern Clarke County, Alabama; and Cocoa Sand Member of Yazoo Clay, Eocene, Choctaw County, Alabama. — VSN

01188 **Welch, D. M.** Substitution of space for time in a study of slope development: Jour. Geology, v. 78, no. 2, p. 234-239, illus., 1970.

To check the validity of the commonly accepted view that rate of erosion decreases gradually with time (G. K. Gilbert, 1877; W. M. Davis, 1899), a detailed examination was made of an area of recessional moraines of the Athabasca Glacier with accurately known exposure dates over the past 100 years. Based on slope angles of microrelief features, it is concluded that in this example slope angles (thus rates of erosion) do not change gradually, but have an initial evolutionary phase followed by relatively sudden entry into an equilibrium phase. — REW

01167 **Welge, E. A.** Valpredo oil field: California Oil Fields — Summ. Operations 1969, v. 55, no. 1, p. 45-50, illus., tables, 1970.

Valpredo oil field, near the southeast end of the San Joaquin Valley, Kern County, is on a regional homocline along the southeastern border of the valley. A major northeasterly trending regional fault, the White Wolf, a high-angle reverse fault dipping to the southeast, has been estimated to have a vertical displacement of 5,000-10,000 feet. Formations range from the Oligocene Teyuca Formation to Holocene alluvium; the producing zone is in the uppermost portion of the Miocene "Santa Margarita sandstone," at a drilled depth of 6,695 feet. From 1961-68 more than 49,000 bbl oil have been produced. — MCM

Wells, Richard B. *See* Faill, Rodger T. 01255

Wentz, D. A. *See* Cotter, R. D. 08765

West, R. E. *See* Sumner, J. S. 08599

01245 **Whipple, Janice M.** Glacial geology of the area from Little Falls to Richfield Springs, New York [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3714B, 1970.

08760 **White, George W.** Early geological observations in the American Midwest, *in* Toward a history of geology (C. J. Schneer, editor) — New Hampshire Inter-Disciplinary Conf. History of Geology, 1967, Proc.: Cambridge, Mass., and London, M.I.T. Press, p. 415-425, 1969.

Not until 1700 did the English make many crossings of the Appalachians to eastern Ohio Country, and after 1750, travelers in the central interior provided geological records. Some of these written before 1787 are summarized, describing the Mississip-

pi Valley, in Lewis Evans' text with *Map of the middle British colonies* (1755); extensive flat strata just beyond the mountains, in Peter Kalm's *Niagara Falls* (1751) and *Travels* (1753 in Swedish, 1771 in English); area northwest of Detroit, in Major Robert Rogers' *Concise account* . . . (1765), with references to oil in Pennsylvania; the Great Lakes region, and Wisconsin River and upper Mississippi valleys, in Jonathan Carver's *Travels* . . . (1778); Illinois Country, in Thomas Hutchins' *Topographic description* (1778), with references to mineral deposits; and the first organized summary of geology in the United States, mostly eastern, *in* Johann Schopf's *Beytrage zur Mineralischen Kentniss* . . . (1787, never in English). — GDC

White, George W. *See* Featherstonhaugh, G. W. 08849

01111 **White, Owen L.** Pre-glacial re-entrant valleys of the Niagara escarpment [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 409, 1970.

White, W. Arthur. *See* Collinson, Charles. 01064

Whitham, K. *See* Weichert, D. H. 08613

01178 **Whitman, Robert V.** Evaluation of soil properties for site evaluation and dynamic analysis of nuclear plants, *in* Seismic design for nuclear power plants (Robert J. Hansen, editor): Cambridge, Mass., M.I.T. Press, p. 270-305, illus., 1970.

A linear viscoelastic model is used to account for stress-strain characteristics of soils for application to design of nuclear plants. — BFG

01112 **Whitney, Marion I.** The role of differential pressure in the formation of embossed aeolian vortex pits [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 409, 1970.

Whitsett, Robert. *See* Couch, Richard. 08656

08785 **Whitten, Charles A.** Recent studies by the Coast and Geodetic Survey [summ.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 5, p. 401-402, 1969.

The U.S. Coast and Geodetic Survey has been engaged in a broad program of monitoring crustal movement along the San Andreas fault system. Studies of crustal deformation in Alaska, Washington, Colorado, Adirondacks, and northern New York are reviewed briefly. — KAF

08666 **Wickman, Frans E.** Meteorites — Samples of the planetary system at large: Earth and Mineral Sci., v. 39, no. 2, p. 9-13, illus., 1969.

Meteorites consist either of nickel-iron with very small amounts of silicates, or of silicates with minor amounts of nickel-iron. Irons are divided into hexahedrites, octahedrites, and ataxites based on surface structure and nickel content. Stone meteorites comprise 90 percent of all falls, and composition is remarkably constant. Structurally they divide into chondrites, characterized by chondrules; and achondrites, lacking chondrules. Stones consist mainly of silicates, with minor amounts of other oxygen compounds, sulfides, and nickel-iron; olivine and pyroxenes are dominating silicates. Orthopyroxenes can be divided into three groups forming enstatite, bronzite, and hypersthene chondrites; olivine is the major constituent in the last two. Enstatite chondrites are in a highly reduced state not known on Earth. Carbonaceous chondrites of Type I contain hydrous minerals and may represent original meteorite matter. — ESL

Wiewiora, Andrzej. *See* Brindley, G. W. 08495

Wiewiora, Krystyna. *See* Brindley, G. W. 08495

01346 **Wilde, P.; Holden, J.; Isselhardt, C.** Non-destructive wet weighing of marine sediments: Marine Geology, v. 8, no. 2, p. 173-178, 1970.

A rapid Archemedian technique is presented for determining the weight of a marine sediment sample which: (1) maintains to a greater degree during treatment the natural marine sedimentary environment; and (2) eliminates the ambiguities produced by conventional washing, deflocculating, and drying of a marine sample. The weight of the mineral solids in the sample is determined from the density of the mineral solids and the density and volume of a mixture of solids and interstitial water measured with: (a) a tared top loading analytical balance; (b) graduated cylinder; and (c) sea water with a known density determined by a given formula. — *from* Authors' abstract

08667 **Williams, Eugene G.** Prediction in geology: Earth and Mineral Sci., v. 39, no. 2, p. 14-15, illus., 1969.

A knowledge of rock genesis is essential before more accurate predictions of the location and quality of mineral deposits can be made. Techniques for predicting the occurrence of a mineral deposit not showing on the surface include aeromagnetic and geochemical. Knowledge of the physical, chemical, and biological conditions under which nonmetallic deposits formed aid in prediction. Application of this genetic method in prospecting for high-alumina clays in western Pennsylvania is described. Clays were confined to paleotopographic highs which were located by measuring roundness of sand grains in outcrops of the lower sandstone due to leaching. — ESL

08708 **Williams, Howel; McBirney, A. R.** Volcanic history of Honduras: California Univ. Pubs. Geol. Sci., v. 85, 101 p., illus., tables, 1969.

It is found that the basement rocks of Honduras consist chiefly of mica schists, phyllites, and quartzites of Paleozoic age, accompanied in the northern part of the country by subordinate metavolcanic and ultrabasic rocks. Plutonic rocks generally increase in age northward. Most plutons in southern and central Honduras are small subvolcanic bodies of Tertiary age; several in central Honduras are probably of Laramide age, but most of those farther north are much older. Volcanic activity since the Paleozoic is discussed in detail. — GV

Williams, John A. *See* Rhodes, Frank H. T. 01101

Willis, Eric H. *See* Buckley, James D. 01336

08557 **Wilson, Charles W., Jr.** Geologic map of the Cumberland Springs quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 79-SE, scale 1:24,000, separate text, 1969.

Mineral resources that have been mined in the Cumberland Springs quadrangle are limestone from the Bigby-Cannon Limestone and Leipers and Catheys Formations, and chert from the Fort Payne and Warsaw Formations. — MCM

01113 **Wingard, Norman E.** Distribution of lithologies in glacial drift over the southern peninsula of Michigan [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 409-410, 1970.

01156 **Winograd, Isaac J.** Noninstrumental factors affecting measurement of static water levels in deeply buried aquifers and aquitards, Nevada Test Site: Ground Water, v. 8, no. 2, p. 19-28, illus., 1970.

Accurate measurement of static water levels in wells tapping deeply buried aquifers and aquitards at the Nevada Test Site requires evaluation of and correction for several factors exclusive of instrumentation. Both drilling method used and depth of hole at the time of measurement significantly affect determination of the static water level for aquitards, and frequently preclude head determination in an economically justifiable time. Density of fluid in the drill stem and hole deviation affect determination of accurate static water levels for aquifers. In principal aquifers, in which hydraulic gradients are as low as 0.5 foot per mile, direct measurement of depth to water is preferable to pressure-gage measurements at the aquifer face. Case histories and graphs are presented to illustrate the magnitude of errors that can result when these factors are disregarded. — *from* Author's abstract

Withington, C. F. *See* Wagner, N. S. 08745

Wittine, Arthur H. *See* Miller, Barry B. 01088

08768 **Wittlake, Eugene B.** Fossil phylloxerid plant galls from the lower Eocene: Arkansas Acad. Sci. Proc., v. 23, p. 164-167, illus., 1969.

Fossil plant galls were found in the upper Wilcox Formation at Lafe, Ark., in a sparse assemblage of casts of stems, leaves and fruits of aquatic, emergent plants, dominantly monocotyledons; the sandstone appears to represent the central area of a large lake or lagoon. Galls incited by insects are scarce in the fossil record, none described in references resemble the galls presented here; all evidence in the author's collection points to one family, Phylloxeridae. This family of aphids that attack modern hickories, produces a great variety of plant galls, most of which have an orifice produced by emerging young. The fossil galls in question lie well within the limits of size, shape, and other characteristics of present-day phylloxerid galls; the fragmentary leaf compressions may be *Juglandaceae*. — GDC

01281 **Wolcott, Don E.** Geologic map of the Buckeye quadrangle, central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-843, scale 1:24,000, text, 1970.

The limited resources of the Buckeye quadrangle are limestone which is mostly too argillaceous for aggregate and sand that is probably too fine for most concrete or mortar uses. No oil or gas has been produced and the area is largely untested. — MCM

01313 **Wolfe, Jack A.; Wahrhaftig, Clyde.** The Cantwell Formation of the central Alaska Range, *in* Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1968: U.S. Geol. Survey Bull. 1294-A, p. A41-A46, illus., 1970.

01353 **Wood, G. V.** Sediment thin section data, Leg 2, [Chap.] 10 *in* Initial reports of the Deep Sea Drilling Project — V. 2, Leg 2 of cruises of *Glomar Challenger*, Hoboken, N. J., to Dakar, Senegal, Oct.-Nov. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 323-328, table, 1970.

Data tabulated include porosity, particle size, packing, carbonate and noncarbonate particulate components, matrix or cement, and structures and textures. — ESL

08536 **Wood, G. V.** Sediment thin section data, *in* Initial reports of the Deep Sea Drilling Project — V. 1, Leg 1 of cruises of *Glomar Challenger*, Orange, Tex., to Hoboken, N. J., Aug.-Sept. 1968: Washington, D. C., U.S. Govt. Printing Office, p. 348-353, table [1969?].

This report tabulates data on sediment thin sections under the following: observable porosity; particle size; packing; carbonate particulate components; noncarbonates, including quartz, feldspar, rock fragments, organic, and miscellaneous; carbonate and noncarbonate matrix or cement; and structure and textures. — ESL

01276 **Wood, Michael Manning.** The crystal structures of ransomite, $CuFe_2(SO_4)_4 6H_2O$, and roemerite, $Fe^{2+}Fe^{3+}_2(SO_4)_4 14H_2O$, and a proposed classification for the transition metal sulfate hydrates [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3714B, 1970.

01278 **Wood, Milton Darrell.** The influence of ocean tidal loading on solid earth tides and tilts in the San Francisco Bay region, California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 8, p. 3717B, 1970.

01261 **Woodruff, James L.** A self-deactivating piston for a piston corer: Ocean Eng., v. 1, no. 6, p. 597-599, illus., 1970.

Described is a piston containing an internal valve that is closed during penetration and open during extraction of the corer. It requires no cocking or other preparatory steps before use, and prevents liner collapse, core distortion, and consequent erroneous interpretation of the core materials as sometimes occurs when a conventional piston is used (i.e. without a deactivator). — Authors' abstract

Woolsey, James R. *See* Levy, John S. 01172

Worl, R. G. *See* Popenoe, Peter. 01175

01365 **Worsley, T.; Martini, E.** Late Maastrichtian nannoplankton provinces: Nature, v. 225, no. 5239, p. 1242-1243, illus., table, 1970.

It was at first thought that late Maestrichtian nannofossils were more cosmopolitan than the foraminifera, but evidence has come to light that this is not entirely the case. Two of the latest Maestrichtian nannofossil index species, *Tetralithus murus* and *Nephrolithus frequens*, were climatically restricted. If they are indeed provincial, it becomes possible to predict where the most likely additional occurrences of each are likely to be found. A careful search of the Upper Maestrichtian strata containing *Abathomphalus mayaroensis* and(or) *Racemiguembelina fructicosa* might yield *T. murus*, especially in the Tampico Embayment and western Texas. — DBV

Worstell, Paula. *See* Eicher, Don L. 01301

Worzel, J. L. *See* Ewing, M. 08532

Wright, Lauren A. *See* O'Neill, Bernard J. 08663

Wright, Ramil C. *See* Marszalek, Donald S. 08462

Wright, Ramil C. *See* Bandy, Orville L. 08647

Wright, Wilna B. *See* Cohee, George V. 01373

08848 **Wyrick, Granville G.; Lloyd, Orville B., Jr.** Ground water resources, App. H *of* Development of water resources in Appalachia: Cincinnati, Ohio, U. S. Army Corps of Engineers, Office of Appalachian Studies, p. H1-H122, illus., tables, geol. map, 1968 [1969].

The three parts of this report are: (1) occurrence and availability of ground water and cost and optimum development of supplies for the Appalachian region as a whole; (2) a summary by water subregion of the generalized information in part 1; and (3) ground water information at specific sites which have been selected because of obvious needs for local water supplies to stimulate local economic growth. The first two parts are intended for use in broad area planning and not to give specific ground-water information at specific sites; considered with other water resources reports, they will provide a basis for planning development of water resources as a stimulus for economic growth. — MCM

Yarger, Richard D. *See* Cranson, K. R. 01065

Yeager, Joan E. *See* Eitel, Dean F. 01135

Yelverton, J. N. *See* Gilreath, J. A. 08524

01173 **York, D.; Berger, G. W.** $^{40}Ar/^{39}Ar$ age determinations on nepheline and basic whole rocks: Earth and Planetary Sci. Letters, v. 7, no. 4, p. 333-336, table, 1970.

One biotite, one nepheline, and two samples of basic dikes have been irradiated in a nuclear reactor and Ar-40/Ar-39 ages have been calculated. These ages agree well with conventional K-Ar ages on the same materials, differing at most by 3.5 percent. — Authors' abstract

08681 **Yzaguirre S., L. A.** Geología regional de la Cuenca de Burgos [abs.]: Inst. Mexicano Petróleo Rev., v. 1, no. 3, p. 79-80, 1969.

08582 **Zaborski, Jerzy.** Meteoritic origin of certain macro-tectonic landforms [abs.]: Arizona Acad. Sci. Jour., v. 5, 1969 Proc. Supp., p. 26, 1969.

Zaitzeff, James B. *See* Orr, William N. 01191

08501 **Zeck, Hubert P.** Measurement of the distortion index (Delta) of cordierite: Am. Mineralogist, v. 54, nos. 11-12, p. 1728-1731, illus., 1969.

Cordierite occurs in different structural states; this probably reflects order-disorder relations of Al-Si and Mg-Al. The variation in structure can be traced using X-ray diffraction analysis and expressed by the distortion index Δ. The use of $K\alpha_1$ reflections permit more reliable determination of the distortion. — JWC

01257 **Zemanek, Joe; Glenn, E. E.; Norton, L. J.; Caldwell, R. L.** Formation evaluation by inspection with the borehole televiewer: Geophysics, v. 35, no. 2, p. 254-269, illus., 1970.

The televiewer takes an oriented acoustic picture of the inside of the well bore in the form of a continuous well log. The resulting log is a representation of the well bore wall as if it were split vertically along magnetic north and laid out flat. Both induced and natural fractures are defined in remarkable detail. Well bores can be filled with any homogeneous liquid such as lease crude oil, water, or drilling mud. Resolution of the tool is sufficient to locate fractures 1/32 inch wide. Examples of natural fractures in extremely fractured formations, in shales, and also drilling-induced fractures are discussed. Fracture orientation information useful for local and regional tectonic studies is presented. — Authors' abstract

01114 **Ziegler, Willi.** On microstructure and surface ornamentation of conodonts [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 410, 1970.

01115 **Ziegler, Willi.** On some aspects of phylogenetic and homeomorphic development among Silurian, Devonian, and Lower Carboniferous genera [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 6, p. 410-411, 1970.

01318 **Zodrow, Erwin L.** Factor analyses and magnetite formation and distribution in the Smallwood mine: Soc. Mining Engineers AIME Trans., v. 247, no. 1, p. 61-69, illus., 1970.

A geological model of the modes of formation of magnetite and its distribution in the Smallwood iron-ore mine, Labrador, Newfoundland, is given, based on observation and geological mapping. This is called the conceptual model. If mathematical expressions plus probabilistic uncertainty are used to represent the conceptual model, then this is termed a mathematical model. The purpose of this paper is to test if there exists a correspondence between the conceptual model and two related mathematical models (called factor analysis). Details of the statistical technique are given. The results of factor analysis in relation to the magnetite formations in the Smallwood mine are discussed. Several practical mine applications are presented. — Author's abstract

INDEX

[The numbers refer to entries in the abstracts]

Absolute age, dates
Carbon-14
Canada, Geological Survey listing: Lowdon, J. A. 01335
General listing, ISOTOPES laboratory: Buckley, James D. 01336
General listing, Smithsonian laboratory: Stuckenrath, Robert, Jr. 01338
General listing, Univ. Michigan laboratory: Crane, H. R. 01381
General listing, Univ. Wisconsin laboratory: Bender, Margaret M. 01339
General listing, University of Texas laboratory: Valastro, S., Jr. 01340
General listing, U.S. Geological Survey laboratory: Sullivan, Beverly Marsters. 01382
Georgia, Okefenokee Swamp, peat: Bond, T. A. 01380
Indiana, Lake Chicago sediments, Glenwood stage: Schneider, Allan F. 01102
Manitoba, Holocene lake sediment: Ritchie, J. C. 08766
Newfoundland, general listing, Trondheim laboratory: Nydal, Reider. 01337
North Dakota, southeastern, lacustrine deposit: Bickley, William B., Jr. 01055
Northwest Territories, Baffin Island, marine shells: Andrews, J. T. 01251
Oregon, Newberry Volcano, Holocene flows, charcoal in tree molds: Peterson, N. V. 08687
West Virginia, Morgantown area, wood: Parsons, Barbara Mae. 01222
Gneiss
Colorado, West Needle Mts., Twilight Gneiss, Rb-Sr: Barker, Fred. 08658
Metasediments
Ontario, Gunflint Fm., Rb-Sr: Misra, A. 01185
Absolute age, methods
Argon-argon
Nepheline, basic whole rock, nuclear reactor irradiated: York, D. 01173
Carbon-14
Gastropod shells, archeological sites, correction for fossil lime: Clark, John W., Jr. 08696
Electron spin resonance
Conodont dating: Morency, Maurice. 01204
Potassium-argon
Basalt, deep-sea pillows: Dymond, Jack. 01136
Radiation damage
Electron spin resonance detection: McMorris, Daniel W. 01299
Alabama
Paleontology
Bryozoa-Anthozoa, Eocene, intergrowths: Greeley, Ronald. 01218
Stratigraphy
Eocene, Bashi Marl Member of Hatchetigbee Fm., Clarke County, type locality: Welby, Charles W. 08603
Alabama – Continued
Stratigraphy – Continued
Eocene, Cocoa Sand Member of Yazoo Clay, Choctaw County, type locality: Welby, Charles W. 08603
Alaska
Absolute age
C-14, general listing, U.S. Geological Survey laboratory: Sullivan, Beverly Marsters. 01382
Geochemistry
Barrow area, ionic concentration gradients, permafrost: Brown, Jerry. 08823
Fortymile area, geochemical prospecting: Foster, Helen L. 01306
Southeastern, glaciomarine sediment-sea water interaction: Sharma, Ghanshyam D. 01139
Geomorphology
Barrow area, permafrost, ionic concentration gradients application: Brown, Jerry. 08823
Southeastern, snow-bank kames, genesis and collapse rate: McKenzie, G. D. 01352
Geophysical surveys
Gravity map, U.S. Geol. Survey, progress report: Barnes, David F. 08579
Maps, geologic
Charley River quadrangle: Brabb, Earl E. 08561
Paleontology
Mollusca, Devonian, Lower, east-central, new cricoconarids, zonation: Churkin, Michael, Jr. 08845
Pteridophytes, Devonian, graptolitic shale, Noyes Island: Churkin, Michael, Jr. 08672
Stratigraphy
Cenozoic, Tlevak Basalt, new, Prince of Wales Island: Eberlein, G. Donald. 01309
Charley River quadrangle, sections: Brabb, Earl E. 08561
Devonian, Lower, east-central sections, cricoconarid zonation: Churkin, Michael, Jr. 08845
Paleocene, Cantwell Fm., central Alaska Range, nomenclature: Wolfe, Jack A. 01313
Structural geology
Aleutian Ridge, Buldir Depression, genesis: Marlow, M. S. 01376
Tectonic stresses, isallo stress analysis: Ranken, R. E. 08612
Alberta
Economic geology
Petroleum, natural gas, Keg River reefs: Robertson, J. W. 08840
Geomorphology
Athabasca Glacier moraines, slope erosion, rate: Welch, D. M. 01188
Maps, geologic index
Sheet 83: Canada Geological Survey. 01266
Paleontology
Gymnosperms, Cretaceous, Edmonton Fm., Drumheller area, Taxodiaceae: Ramanujam, C. G. K. 08767

Algae
Tertiary
Colorado-Wyoming-Utah, Green River oil shale progenitors: Bradley, W. H. 01250
Amphibia
Trematops stonei sp. nov.
Permian, Ohio, Creston Shale, Marietta area: Olson, Everett C. 01270
Angiosperms
Arecaceae
Cretaceous-Oligocene, Oregon: Gregory, Irene. 08688
Populus
Eocene, Clarno Fm., Oregon, worm-bored: Gregory, Irene. 08653
Anthozoa
Quaternary
North Carolina, Holocene, beaches, anemone burrows: Frey, R. W. 01279
Tertiary
Alabama-Mississippi, Eocene, intergrowths on bryozoan zoaria: Greeley, Ronald. 01218
Antimony
Oregon
Resources, production history: Wagner, N. S. 08727
Appalachians
Hydrogeology
Ground-water resources, summary: Wyrick, Granville G. 08848
Stratigraphy
Ordovician, Upper, lithofacies, nomenclature: Thompson, Allan M. 01147
Structural geology
Orogeny, role of plate tectonics: Bird, John M. 01137
Arctic Ocean
Geochemistry
Sediments, manganese migration: Li, Yuan-Hui. 08850
Geophysical surveys
Sea ice, remote-sensing techniques: McLerran, James H. 08770
Argon
Isotopes
Ar-40, pillow basalt, excess: Dymond, Jack. 01136
Arizona
Areal geology
Pinal County, Lakeshore mine area: Harper, H. E. 08809
Economic geology
Copper, Pinal County, Lakeshore deposit: Harper, H. E. 08809
General
Education, Phoenix, Maryvale High School, earth science program: Edgar, Robert A. 08597
Exploration, geobotanical, Swisshelm Mts., soils, rock types: Bradbury, David. 08583
Geochemistry
Montezuma Well, travertine forming discharge, dynamics: Cole, Gerald A. 08607
San Pedro Valley, titanium, tungsten minerals, activation analysis: Kuck, Peter. 08587
Geomorphology
Wupatki National Monument, drainage, Pliocene channel, controls: Breed, William J. 08605
Arizona—Continued
Geophysical surveys
Gravity, program since 1965: Sumner, J. S. 08599
Glacial geology
White Mountains, glacial features, late Pleistocene history: Merrill, Robert K. 08591
Hydrogeology
Gila River valley, ground-water movement, observation network: Myrick, R. M. 01253
Gila River valley, water quality, variance: Laney, R. L. 01152
Graham County, Gila River floodplain, phreatophyte control: Culler, R. C. 01150
Montezuma Well, travertine forming discharge, dynamics: Cole, Gerald A. 08607
Mineralogy
Iron meteorite, Camp Verde, chemical analysis: Lewis, Charles F. 08589
Paleontology
Crinoidea, Carboniferous, n. spp., index value: Webster, G. D. 01214
Mammalia, Pleistocene, *Mammuthus*, distribution: Saunders, Jeffrey J. 08592
Mammalia, Pliocene-Pleistocene, San Pedro Valley, mammoth: Hemmings, E. Thomas. 08606
Petrology
Superstition Mountains, Black Mesa caldera, basanite lava: Sheridan, Michael F. 08596
Tucson Mountain Park, fragmental diapir: Mayo, Evans B. 08644
Wikieup area, stony meteorite: Lewis, Charles F. 08588
Sedimentary petrology
Payson Basin, Tertiary-Quaternary sediments: Pedersen, Edward P. 08594
Stratigraphy
Cretaceous, Bisbee Group, Empire Mts. quadrangle, nomenclature: Finnell, Tommy L. 01310
Oligocene-Miocene, Pantano Fm., new, Empire Mts. quadrangle: Finnell, Tommy L. 01311
Tertiary, Hickey Fm., Sedona-Rimrock area, revision: Scholtz, Judith Fessenden. 08609
Structural geology
Doney Crater area, faults, lava flows, stream control: Breed, William J. 08605
Stoneman Lake basin, faults, lava walls, circular collapse: Scholtz, Judith Fessenden. 08590
Tucson Mountain Park, fragmental diapir: Mayo, Evans B. 08644
Verde Valley area, tectonics, volcanics, NE migration: Scholtz, Judith Fessenden. 08609
Arkansas
Geomorphology
Fayetteville area, prairie mounds, alluviation age, from artifacts: Beckman, Michael A. 08699
Newton County, Peccary Cave, biostratigraphy: Davis, Leo Carson. 08698
Paleontology
Cephalopoda, Pennsylvanian, Morrow Group, northern, goniatite fauna: Quinn, James Harrison. 08697
Insecta, Eocene, Wilcox Fm., phylloxerid plant galls: Wittlake, Eugene B. 08768
Mammalia, Quaternary, Peccary Cave, Altithermal assemblage: Davis, Leo Carson. 08698
Stratigraphy
Jurassic, Upper: Dickinson, Kendell A. 08522

Arkansas—Continued
Stratigraphy—Continued
Mississippian, Kinderhook-Osage Series, northwestern, conodont zones: Thompson, Thomas L. 01361
Paleozoic, Ouachita Mountains, pre-Womble Shale section: Madeley, Hulon M. 01325
Pennsylvanian, Hale and Bloyd Fms., biofacies, goniatite fauna: Quinn, James Harrison. 08697
Artifacts
Arizona
San Pedro Valley, Clovis points, Escapule mammoth site: Hemmings, E. Thomas. 08606
Arkansas
Fayetteville area, Middle Archaic projectile points, age: Beckman, Michael A. 08699
Asbestos
Oregon
Occurrence, potential: Wagner, N. S. 08798
Associations
Royal Geographical Society
Echo-sounding symposium, 1969: Harland, Brian. 08700
Society Econ. Paleontologists and Mineralogists
History, 1926-46: Russell, R. Dana. 01209
Atlantic Coastal Plain
Geomorphology
New Jersey-Georgia, terraces, eustatic, tectonic changes of level: Richards, Horace G. 08481
Atlantic Ocean
General
Deep Sea Drilling Project, Leg 2, summary: Peterson, M. N. A. 01360
Geochemistry
Deep Sea Drilling Project, Leg 1, core samples, interstitial water: Kaplan, I. R. 08543
Deep Sea Drilling Project, Leg 1, core samples, interstitial water: Manheim, F. T. 08542
Deep Sea Drilling Project, Leg 2, sediments, interstitial water: Kaplan, I. R. 01357
Deep-sea sediments, carbon, organic and carbonate: Deep Sea Drilling Project. 01385
Geomorphology
Mid-Atlantic Ridge, relief features, morphometric analysis: Bogorov, G. V. 08713
Geophysical surveys
Bahama platform-Hatteras plain, well logging: Kennedy, K. F. 08604
Maps, bathymetric
Great Bahama Canyon: Andrews, James E. 01138
Mineralogy
Deep Sea Drilling Project, Leg 2, cores, mineral abundances: Rex, R. W. 01354
General, deep-sea sediments, X-ray data: Rex, R. W. 08537
Paleontology
Foraminifera, Cenozoic, deep-sea cores, biostratigraphy: Berggren, W. A. 08546
Foraminifera, Cretaceous-Pleistocene, deep-sea cores, biostratigraphy: Blow, W. H. 01356
Foraminifera, Cretaceous-Tertiary, deep-sea cores, larger: Sachs, K. N., Jr. 08540
Foraminifera, Jurassic-Pleistocene, deep-sea cores, biostratigraphy: Blow, W. H. 08539
Microfossils, Cretaceous-Pleistocene, correlation: Cita, Maria B. 01359
Microfossils, Cretaceous-Tertiary, Deep Sea Drilling Project: Peterson, M. N. A. 01371
Protista, Cretaceous-Pleistocene, cores, age-diagnostic, coccoliths: Bukry, David. 01355
Atlantic Ocean—Continued
Paleontology—Continued
Protista, Jurassic-Pleistocene, deep-sea cores, nannoplankton: Hay, W. W. 08538
Protista, Jurassic-Tertiary, Blake-Bahama basin, Bermuda rise: Bukry, David. 08548
Radiolaria, Tertiary, deep-sea cores, Bermuda Rise: Riedel, W. R. 08541
Petrology
Mid-Atlantic Ridge, sills, cores: Engel, A. E. J. 01358
Sedimentary petrology
Bahama platform-Hatteras plain, cores, carbon, carbonate contents: Deep Sea Drilling Project. 08535
Bahama platform-Hatteras plain, cores, water content: Deep Sea Drilling Project. 08534
Bahamas-North Carolina, deep-sea sediments, cores: Ewing, M. 08532
Deep Sea Drilling Project, Leg 2, cores: Peterson, M. N. A. 01371
Deep Sea Drilling Project, Leg 2, thin-section data: Wood, G. V. 01353
Deep-sea cores: Beall, A. O., Jr. 08545
Deep-sea sediments, Drilling Project, Leg 2: Peterson, Melvin N. A. 01268
Stratigraphy
Cretaceous-Pleistocene, deep-sea cores, biostratigraphy: Cita, Maria B. 01359
Cretaceous-Pleistocene, deep-sea cores, Foraminifera, biostratigraphy: Blow, W. H. 01356
Cretaceous-Pleistocene, deep-sea cores, summary charts: Peterson, Melvin N. A. 01268
Cretaceous-Tertiary, Deep Sea Drilling Project, Leg 2: Peterson, M. N. A. 01371
Structural geology
Mid-Atlantic Ridge, migration and shear: Ball, M. M. 08528
Automatic data processing
Bibliography
Statistical methods: McIntyre, Donald B. 08816
Earth science
International storage and retrieval: Robinson, S. C. 08512
Network concept for data, Canada: Burk, C. F., Jr. 08514
Program for information center: Lloyd, Joel J. 08511
Economic geology
Petroleum exploration, sample normality tests, program: Preston, D. A. 01118
Uranium, resource prediction, application, Arizona-New Mexico: Bostick, Neil H. 01316
General
APL-360 retrieval system: McIntyre, Donald B. 08835
Minimum entropy criterion, analytic rotation: McCammon, Richard B. 01291
Modeling, geologic processes: Pollack, Henry N. 08817
Oral descriptions, storage and retrieval: Dahlem, D. H. 08515
Geochemistry
Storage and retrieval system, Chemical Abstracts Service: O'Dette, Ralph E. 08513
Geophysics
Dirichlet and Poisson problems: Sturgul, J. R. 08506
Time sharing in mining: Halverson, Mark O. 08505
Mineral economics
Appraisal of potential: Harris, D. P. 08508

Automatic data processing—Continued
Mineral exploration
Computer graphics, application: Kaas, L. Michael. 08504
Information flow, computer-oriented: Demeter, E. J. 08516
Machine representation of geologic information: Dixon, Colin J. 08509
Stratiform deposits, grade estimation: David, Michel. 08507
Mining geology
Computer graphics, application: Kaas, L. Michael. 08504
GIPSY system, uses: Sweeney, James W. 08510
Petrology
CORFAN-FORTRAN IV rock classification: Ondrick, C. W. 01362
Structural geology
Orientation data analysis, stereograms by computer: LaFountain, Lester J. 01144
Well logging
Sandy shale, multiple porosity logging data: Konen, C. E. 01271
Bahamas
Geomorphology
Bahama Banks, hydrography, remote-sensing photography: Ross, D. S. 08689
Great Bahama Canyon, description: Andrews, James E. 01138
Maps, bathymetric
Great Bahama Canyon: Andrews, James E. 01138
Paleontology
Foraminifera, Radiolaria, Mesozoic, planktonic, deep-sea cores: Pessagno, E. A., Jr. 08547
Sedimentary petrology
Exuma sound, calcareous core, consolidation-compression studies: Miller, Donald G., Jr. 08661
San Salvador Island, core, facies, diagenetic, depositional: Supko, Peter R. 08484
Structural geology
Platform subsidence, relation to sea-floor spreading rate: Lynts, George W. 01295
Basins, structural
Alaska
Buldir Depression, Aleutian Ridge, genesis: Marlow, M. S. 01376
Arizona
Stoneman Lake basin, collapse structure, fault, control: Scholtz, Judith Fessenden. 08590
Sedimentation
Arizona, Payson Basin, Tertiary-Quaternary: Pedersen, Edward P. 08594
Batholiths
Montana
Boulder and Tobacco Root, gravity surveys: Burfeind, Walter J. 08572
Bauxite
Oregon
Northwestern and Willamette Valley, resources, production: Corcoran, R. E. 08728
Bermuda
Paleontology
Gastropoda, Pleistocene, shell diversity: Gould, Stephen Jay. 01207
Bibliography
Authors
Nielsen, Eigil: Poulsen, Christian. 08712
Stille, Hans: Brinkmann, Roland. 01119
Automatic data processing
Statistical methods: McIntyre, Donald B. 08816
Bibliography—Continued
General
Terrain sciences: Eitel, Dean F. 01135
Statistical methods
Automatic data processing: McIntyre, Donald B. 08816
Vertebrata
Louisiana, Mississippi: Domning, Daryl P. 08464
Biography
Douglass, David Bates
Journal, 1820: Jackman, Sydney W. 08824
Featherstonhaugh, George William:
Featherstonhaugh, G. W. 08849
Illing, Vincent Charles: Kugler, Hans G. 01132
Nielsen, Eigil
Bibliography: Poulsen, Christian. 08712
Stille, Hans
Bibliography: Brinkmann, Roland. 01119
Blastoidea
Mississippian
Nevada, Indian Springs Fm., n. spp., index value: Webster, G. D. 01214
Borates
Oregon
Eastern, possibilities: Wagner, N. S. 08743
Brachiopoda
Devonian
Nevada, central, early Middle, zonation, n. spp.: Johnson, J. G. 01211
Dubaria megaeroides, n. sp.
Silurian, Nevada, central, Tor Limestone: Johnson, J. G. 01212
Leptathyris circula zone
Devonian, early Middle, Nevada, central, zonation, n. spp.: Johnson, J. G. 01211
Quaternary
Modern habitats cf. Paleozoic, lingulids: Paine, Robert T. 01378
Silurian
Nevada, central, Tor Limestone, correlation, age: Johnson, J. G. 01212
Breccia
Lithoclastic
El Doctor Formation, Mexico, Hidalgo: Carrasco V., B. 08615
Oregon
Cedar Butte area, volcanic: Nelson, Dennis O. 08686
British Columbia
Maps, geologic index
Sheets 94 and 103: Canada Geological Survey. 01267
Maps, magnetic
Ankwill Creek area, airborne: Canada Geological Survey. 01038
Gunanoot Lake area, airborne: Canada Geological Survey. 01040
Hilary Lake area, airborne: Canada Geological Survey. 01043
Kenny Creek area, airborne: Canada Geological Survey. 01037
Kisgegas area, airborne: Canada Geological Survey. 01041
Kotsine River area, airborne: Canada Geological Survey. 01044
Lion Creek area, airborne: Canada Geological Survey. 01045
Nilkitkwa River area, airborne: Canada Geological Survey. 01039
Ogden Creek area, airborne: Canada Geological Survey. 01046

British Columbia—Continued
Maps, magnetic—Continued
Shedin Creek area, airborne: Canada Geological Survey. 01042
Paleontology
Cephalopoda, Cretaceous, Fort St. John Group: Warren, P. S. 08846
Palynology, Holocene, Atlin Valley: Anderson, James H. 01047
Sedimentary petrology
Fraser River delta, Holocene sediments, cementation: Garrison, Robert E. 08695
North-central, Sustut and Bowser Fms.: Allen, Gary Wayne. 01168
Bryozoa
Lunulitidae
Eocene, Alabama-Mississippi, corallite intergrowths on zoaria: Greeley, Ronald. 01218
Ordovician
New York, Mohawkian, descriptions, paleoecology, correlation: Ross, June Phillips. 01280
Paleozoic
Biometric procedures in taxonomy: Anstey, Robert L. 01219
Pseudostrictoporella typicalis, n. gen., n. sp.
Ordovician, New York-Ontario, Rockland Fm.: Ross, June Phillips. 01280
Silurian
New York, Rochester Shale, Niagara region, cf. England, Sweden: Owen, David E. 08671
Taxonomy
Numerical, biometric procedures, Paleozoic: Anstey, Robert L. 01219
California
Areal geology
General, correspondence course text: Webb, Robert W. 08711
Earthquakes
Prediction, fault movement monitoring: Hofmann, Renner B. 08773
San Andreas fault, seismicity: Brune, James N. 08776
San Andreas fault system, stress relief: Evans, David M. 08779
Economic geology
Lithium, Searles Lake, brines: O'Neill, Bernard J. 08663
Mineral resources, review 1969: Davis, Fenelon F. 01369
Natural gas, Clarksburg field, Pollock and Forbes sands: Lorshbough, A. L. 01254
Natural gas, Northwest San Joaquin field, Nortonville sands: Hill, F. L. 01166
Petroleum, natural gas, Cymric field: Anderson, David N. 01164
Petroleum, natural gas, Elk Hills field, gravity exploration: Corbató, Charles E. 08577
Petroleum, Valpredo field, Santa Margarita sandstone: Welge, E. A. 01167
Geomorphology
Mojave Desert, stream channels, cf. lunar rilles: Burke, J. D. 01296
Geophysical surveys
Continental margin, southern, seismic profiles, interpretation: Moore, David G. 08669
Division of Mines and Geology gravity program: Chapman, Rodger H. 08574
Elk Hills oil field, gravity, progress report: Corbató, Charles E. 08577
San Andreas fault, magnetometer array, progress: Kovach, Robert L. 08783
California—Continued
Geophysical surveys—Continued
San Francisco Bay area, earth tides, tilts, ocean tidal loading: Wood, Milton Darroll. 01278
Transverse Range Province, gravity, recent work, summary: Rietman, Jan D. 08576
U.S. Geol. Survey cooperative gravity program, since 1963: Oliver, Howard W. 08575
Maps, structure
Clarksburg gas field: Lorshbough, A. L. 01254
Cymric oil and gas field, top of Phacoides sandstone: Anderson, David N. 01164
Northwest San Joaquin gas field, top of Domengine Fm.: Hill, F. L. 01166
Valpredo oil field, top of Santa Margarita sandstone: Welge, E. A. 01167
Paleoclimatology
Quaternary, Mojave Desert, montane forests, pluvial expansion: Mehringer, Peter J., Jr. 08608
Paleontology
Foraminifera, Quaternary, Tanner Basin, paleoecology: Kheradpir, Ahmad. 01302
Gymnosperms, Quaternary, Mojave Desert, Clark Mtn., bristlecone pine: Mehringer, Peter J., Jr. 08608
Petrology
Coast Ranges, Franciscan rocks cf. Japan, metamorphism, data: Seki, Y. 08714
Leech Lake Mountain-Anthony Peak region, Franciscan rocks: Suppe, John Edward. 01244
Southern, Lakeview pluton, trend surfaces, significance test: Chayes, Felix. 01145
Sedimentary petrology
Santa Barbara area, Monterey Shale, fault-graded beds, seismites: Seilacher, Adolf. 08821
Structural geology
Coast Ranges, Nacimiento fault, location in Burro Mtn. area: Loney, Robert A. 01148
Fault movement monitoring, earthquake prediction: Hofmann, Renner B. 08773
Hayward-Calaveras fault zone, creep: Tocher, Don. 08777
Leech Lake Mountain-Anthony Peak region, Franciscan rocks: Suppe, John Edward. 01244
San Andreas fault, strain and displacement: Raleigh, C. B. 08772
San Andreas fault system, tectonics: Pakiser, L. C. 08831
San Andreas fault, tectonics, recent earthquakes: Wallace, Robert E. 08771
San Andreas, San Gabriel faults, post-Oligocene slip: Jahns, Richard H. 08775
San Francisco Bay area, Hayward fault, rupture mechanics: Bolt, Bruce A. 08774
Cambrian
Illinois
Stratigraphy: Buschbach, Thomas C. 01058
Indiana
Subsurface, stratigraphy: Becker, Leroy E. 01052
Michigan
Sedimentation, structural control: Fisher, James H. 01072
Nebraska
Subsurface, stratigraphy: Carlson, Marvin P. 01059
Ohio
Subsurface, Sauk sequence: Janssens, A. 01078
Oklahoma
Wichita-Arbuckle Mts., biostratigraphy: Stitt, James H. 01105

Cambrian—Continued
United States
Appalachians to midwest, sedimentation: Prouty, C. E. 01097
Ordovician boundary, age discrepancies: Miller, James F. 01089
Wisconsin
Western, Franconia Fm., sedimentation: Dapples, E. C. 01067
Canada
Absolute age
C-14, general listing, Univ. Wisconsin laboratory: Bender, Margaret M. 01339
C-14, Geological Survey listing: Lowdon, J. A. 01335
Economic geology
Iron, Labrador Trough, exploration, geophysical, interpretation methods: Seguin, Maurice K. 01317
General
Earth-science data, network concept: Burk, C. F., Jr. 08514
Well and drill core and sample storage, western depositories: Pow, J. R. 08762
Geomorphology
Canadian Shield, meteor craters, related tectonic features: Zaborski, Jerzy. 08582
Geophysical surveys
General, Dominion Observatory pendulum apparatus: Valliant, H. D. 08568
Stratigraphy
Cretaceous, Fort St. John Group, western, biostratigraphy: Warren, P. S. 08846
Carbon
Geochemistry
Deep-sea cores, organic and carbonate, Atlantic Ocean: Deep Sea Drilling Project. 01385
Isotopes
C-13:C-12, Pleistocene sediments, organic matter, Gulf of Mexico: Rogers, M. A. 08478
Carboniferous
United States
Southwestern, Blastoidea, Crinoidea, n. spp., index value: Webster, G. D. 01214
Western, conodonts, Chester-Morrow, phylogeny: Dunn, D. L. 01217
Caribbean region
Areal geology
Nicaraguan Rise, history: Arden, Daniel D., Jr. 08459
Geophysical surveys
Lesser Antilles-Venezuela-Trinidad-Tobago, interpretation, seismic: Weeks, L. A. 08530
Maps, gravity
Antilles Island and Venezuelan Basin, isostatic anomalies: Bush, Sam A. 08458
Paleontology
Foraminifera, Pliocene-Pleistocene, boundary datums, cf. Italy: Lamb, James L. 08553
Ostracoda, Cenozoic, *Costa* distribution: Bold, W. A. van den. 01303
Stratigraphy
Pliocene-Pleistocene, boundary, foraminiferal datums, cf. Italy: Lamb, James L. 08553
Structural geology
Lesser Antilles-Venezuela-Trinidad-Tobago, relations: Weeks, L. A. 08530
N-S extension and left-lateral shear, relation to sea-floor spreading: Ball, M. M. 08528
Tectonic relations with Central American: Dengo, Gabriel. 08529
Caribbean Sea
Geochemistry
Cariaco Trench, sediment cores, U, Th, Pa: Rona, Elizabeth. 08527
Sedimentary petrology
Courtown, Albuquerque, Roncador atolls, lagoon sediments: Milliman, John D. 08445
Quaternary core, geochemistry, mineralogy, absolute age: Bonatti, E. 08475
Caves
Arkansas
Peccary Cave, biostratigraphy, Altithermal mammals: Davis, Leo Carson. 08698
Oregon
Saddle Butte area, lava-tube caves: Ciesiel, Robert F. 08651
Cenozoic
Alaska
Prince of Wales Island, Tlevak Basalt, new: Eberlein, G. Donald. 01309
Arizona
Payson Basin, Tertiary-Quaternary sediments: Pedersen, Edward P. 08594
Atlantic Coastal Plain
New Jersey-Georgia, changes of level: Richards, Horace G. 08481
Atlantic Ocean
Deep Sea Drilling Project, Leg 1, Foraminifera, biostratigraphic: Berggren, W. A. 08546
Caribbean region
Ostracoda, *Costa*: Bold, W. A. van den. 01303
Pliocene-Pleistocene boundary, Foraminifera, datums, cf. Italy: Lamb, James L. 08553
Florida
Northern, uplift, raised shorelines: Hoyt, John H. 08517
Gulf Coastal Plain
Gulf Coast basin delta systems, Holocene analogs: Fisher, W. L. 08518
Gulf of Mexico
Deep Sea Drilling Project, Leg 1, Foraminifera, biostratigraphy: Berggren, W. A. 08546
Pliocene-Pleistocene boundary, Foraminifera, datums, cf. Italy: Lamb, James L. 08553
Honduras
Tegucigalpa area, stratigraphy: Honduras Instituto Geográfico Nac. 01159
Maryland
Harford County, gravels: Owens, James P. 08827
Washington
Camas area, Prune Hill, paleogeography: Aviolo, Gennara. 01195
Wyoming
Granite Mountains area, stratigraphy: Love, J. D. 01293
Central America
Absolute age
C-14, general listing, Univ. Michigan laboratory: Crane, H. R. 01381
Structural geology
Tectonic relations with Caribbean: Dengo, Gabriel. 08529
Cephalopoda
Ammonoidea
Pennsylvanian, Morrow Group, biostratigraphy, goniatite fauna: Quinn, James Harrison. 08697
Aturia alabamensis
Eocene, Jackson fm., Louisiana, Montgomery: Gimbrede, Louis de A. 08477

Cephalopoda—Continued
Christioceras sp.
Pennsylvanian, Texas, western, Magdalena Fm., arctic genus: Nassichuk, W. W. 01220
Domatoceras gardi, n. sp.
Pennsylvanian, Ohio, eastern, Brush Creek Ls.: Murphy, James L. 01210
Metacoceras mcchesneyi, n. sp.
Pennsylvanian, Ohio, eastern, Brush Creek Ls.: Murphy, James L. 01210
Neogastroplites
Cretaceous, Canada, western, Fort St. John Group, succession: Warren, P. S. 08846
Neogastroplites cornutus wilderensis, n. subsp.
Cretaceous, British Columbia, Goodrich and Sikanni Fms.: Warren, P. S. 08846
Pennsylvanian
Ohio-Pennsylvania, Brush Creek Ls., coiled nautiloids: Murphy, James L. 01210
Ceramic materials
General
Diversity and quantity: Fisher, W. L. 08806
Kansas
Calvert volcanic ash, expansion characteristics, cf. Pearlette: Bauleke, Maynard P. 01203
Changes of level
Atlantic Coastal Plain
Cenozoic, sea level or tectonic: Richards, Horace G. 08481
Northwest Territories
Quaternary, Baffin Island, late glacial: Andrews, J. T. 01251
Chemical analysis
Chromatography
Sedimentary rocks, kerogen: Giraud, A. 01126
Pyrolysis
Sedimentary rocks, kerogen: Giraud, A. 01126
Chromite
Oregon
Occurrence, resources: Thayer, T. P. 08729
Clay mineralogy
Areal studies
Florida, Florida Bay sediments, distribution: Manker, J. P. 08474
Georgia, northwestern, Ordovician bentonite: Martin, B. F. 01326
Oklahoma, Desmoinesian rocks, diagenesis, effects: Bucke, David Perry, Jr. 01228
Pacific Ocean, Cascadia Basin off Oregon, Quaternary lutites: Duncan, John R. 01122
Pacific Ocean, eastern, distribution: Rateev, M. A. 08692
Wyoming, Mowry Shale: Davis, John Clements. 01129
Experimental studies
Colloidal properties: Slabaugh, W. H. 01162
Differential thermal analysis, quantitative: Davis, C. E. 08702
Illite and chlorite, separation, electromagnetic: Berry, Richard. 08703
Montmorillonite, fixation of hydroxy-aluminum: Gupta, G. C. 08494
Montmorillonite, swelling in water-organic mixtures: Brindley, G. W. 08495
Clays
Oregon
Northwestern and western, occurrence, resources: Mason, R. S. 08795
Pennsylvania
Mather quadrangle, occurrence: Kent, Bion H. 08790
Western, exploration, high-alumina, genetic method: Williams, Eugene G. 08667
Clays—Continued
Properties
Colloidal, industrial use: Slabaugh, W. H. 01162
Coal
Kentucky
Central City West quadrangle, occurrence: Palmer, James E. 08832
Jellico West (Tenn.) quadrangle, occurrence: Englund, Kenneth J. 08793
Lick Creek quadrangle, occurrence: McKay, E. J. 08789
New Mexico
Casa Grande quadrangle, occurrence: Pillmore, Charles L. 08675
Oregon
Occurrence, resources: Mason, R. S. 08755
Pennsylvania
Carmichaels quadrangle, occurrence: Kent, Bion H. 08563
Mather quadrangle, occurrence: Kent, Bion H. 08790
Tennessee
Jellico West quadrangle, occurrence: Englund, Kenneth J. 08793
Welchland quadrangle, occurrence: Garman, R. Keith. 08559
Cobalt
Oregon
Occurrence: Vhay, J. S. 08730
Colorado
Absolute age
West Needle Mountains, Twilight Gneiss, Rb-Sr: Barker, Fred. 08658
Areal geology
Nederland quadrangle: Gable, Dolores J. 08791
Earthquakes
Denver area, strain variations, mechanism: Major, M. W. 08778
Rocky Mountain Arsenal Well area, pore pressure as cause: Evans, David M. 08779
Geochemistry
West Needle Mountains, Twilight Gneiss, Rb, Sr contents, volcanic origin: Barker, Fred. 08658
Geomorphology
Golden area, Clear Creek sand transport, tracer experiment: Kennedy, Vance C. 01294
Geophysical surveys
Aspen area, gravity, Wyoming Univ. program: Smithson, Scott B. 08573
North-central, gravity, magnetic lineations, Tertiary plutonism, relations: Popenoe, Peter. 01175
Maps, geologic
Nederland quadrangle: Gable, Dolores J. 08791
Pueblo quadrangles, SW and SE: Scott, Glenn R. 08562
Paleontology
Foraminifera, Cretaceous, Turonian beds, new heterohelicid: Eicher, Don L. 01301
Petrology
Fremont County, Goldie carbonatite, cryolite occurrence: Heinrich, E. W. 01074
Stratigraphy
Front Range, southern, pre-Pennsylvanian, conodonts: Goebel, Edwin D. 01073
Structural geology
Denver area, secular strain, earthquakes: Major, M. W. 08778
Connate water
Composition
Atlantic Ocean, deep-sea cores: Kaplan, I. R. 01357

Connate water—Continued
Washington
Composition, thermal springs: Campbell, K. Vincent. 01190
Conodonts
Age
Electron spin resonance dating: Morency, Maurice. 01204
Carboniferous
Lower, evolution: Austin, Ronald L. 01189
United States, western, Chester-Morrow, phylogeny: Dunn, D. L. 01217
Classification
Affinities, review: Lindstrom, Maurits. 01080
Evolution
Silurian-Carboniferous, phylogeny, homeomorphic development; Ziegler, Willi. 01115
General
Research, problems, programs, priorities: Rhodes, F. H. T. 01100
Trace-element analyses, bone material: Bradshaw, L. E. 01056
Geographic distribution
Paleozoic: Collinson, Charles. 01063
Paleozoic, Lower, provinces: Barnes, Christopher R. 01049
Paleozoic, upper: Druce, Edric. 01071
Mississippian
Missouri, Kinderhook-Osage Series, biostratigraphy, n. ssp.: Thompson, Thomas L. 01361
Morphology
Animal, Pennsylvanian: Melton, William. 01085
Holoconodont, microstructure: Ziegler, Willi. 01114
Micromorphologic studies, stratigraphic significance: Rhodes, Frank H. T. 01101
Ordovician
Evolution, prioniodid: Bergström, Stig M. 01054
North America, northeastern, ultrastructure: Barnes, Christopher R. 01050
Pennsylvanian
Faunal variations, non-biostratigraphic controls: Merrill, Glen K. 01086
Montana, animal morphology: Melton, William. 01085
Spathognathodus remscheidensis
Silurian-Devonian, New Jersey, New York, evolution: Barnett, Stockton G. 01051
Triassic
Decline, extinction: Mosher, L. Cameron. 01092
Construction materials
General
Diversity and quantity: Fisher, W. L. 08806
Kansas
Aggregate, lightweight, Calvert volcanic ash, cf. Pearlette: Bauleke, Maynard P. 01203
Maryland
Harford County, general, resources: Edwards, Jonathan, Jr. 08828
Montgomery County, Hunting Hill quarry, dunite, occurrence: Larrabee, David M. 08564
Oregon
Occurrence, production, limestone, granite, other stone: Mason, R. S. 08753
Production history: Weissenborn, A. E. 08726
Resources: Wagner, N. S. 08747
Continental drift
General
Research since 1969: Vine, F. J. 01344
Continental drift—Continued
Mechanism
Pole of rotation, Greenland-N. America vs. Europe, velocity rate: Horsfield, W. T. 01300
North America
Paleozoic, proto-Atlantic, plate tectonics role: Bird, John M. 01137
Continental margin
California
Southern, basins, structural and sedimentary, seismic data: Moore, David G. 08669
Greenland
West shelf, marginal channels, genesis: Holtedahl, Olaf. 01386
Mexico
Baja California, basins, structural and sedimentary, seismic data: Moore, David G. 08669
New York
Long Island, shelf, foraminifera, Pleistocene ecology: Gevirtz, Joel L. 01233
Long Island, shelf, sediments: McKinney, Thomas Francis. 01239
North America
Shelf, sedimentation, concept of grade: Swift, Donald J. P. 01377
North Carolina
Cape Hatteras, submarine canyons, genesis: Rona, Peter A. 01120
Copper
Arizona
Pinal County, Lakeshore deposit, occurrence: Harper, H. E. 08809
Oregon
Occurrence, potential: Bowen, R. G. 08731
Correlation
Principles
Series boundary definition, criteria for internat. standard section: Hay, William W. 08646
Series-epochs of Lyell, Tertiary, limitations: Weaver, D. W. 08645
Cretaceous
Alberta
Drumheller area, Gymnosperms, Edmonton Fm., Taxodiaceae: Ramanujam, C. G. K. 08767
Arizona
Empire Mountains quadrangle, Bisbee Group, nomenclature: Finnell, Tommy L. 01310
Atlantic Ocean
Blake-Bahama basin, Bermuda rise, coccolith biostratigraphy: Bukry, David. 08548
Deep Sea Drilling Project, Leg 2, biostratigraphy: Peterson, M. N. A. 01371
Deep Sea Drilling Project, Leg 2, coccolithophores, age diagnostic: Bukry, David. 01355
Deep Sea Drilling Project, Leg 2, Foraminifera, biostratigraphy: Blow, W. H. 01356
Deep Sea Drilling Project, Leg 1, Foraminifera, biostratigraphy: Blow, W. H. 08539
Deep Sea Drilling Project, Leg 1, Foraminifera, larger: Sachs, K. N., Jr. 08540
Deep Sea Drilling Project, Leg 1, Protista, calcareous, age: Hay, W. W. 08538
Deep-sea cores, biostratigraphy: Cita, Maria B. 01359
Canada
Western, Cephalopoda, Fort St. John Group, correlation: Warren, P. S. 08846
Gulf of Mexico
Deep Sea Drilling Project, Foraminifera, biostratigraphy: Blow, W. H. 08539

Cretaceous—Continued
Gulf of Mexico—Continued
Deep Sea Drilling Project, Protista, calcareous, age: Hay, W. W. 08538
Honduras
Tegucigalpa area, stratigraphy: Honduras Instituto Geográfico Nac. 01159
Maryland
Harford County, Potomac Group: Owens, James P. 08827
Mexico
Córdoba-Orizaba area, microfaceis: Bonet Marco, F. 08682
Hidalgo, Metztitlan area, lithofacies: Carrasco Velâquez, B. 08642
Veracruz, Poza Rica district, Tamabra Fm.: Becerra Hernández, A. 08628
Oregon
Angiosperms, palms: Gregory, Irene. 08688
Protista
Maestrichtian provinces, nannofossil restriction: Worsley, T. 01365
Saskatchewan
Southwestern, Viking Fm., sandstone members: Evans, W. E. 01128
United States
Western interior, Foraminifera, Turonian: Eicher, Don L. 01301
Wyoming
Mowry Shale: Davis, John Clements. 01129
Crinoidea
Carboniferous
United States, southwestern, n. spp., index value: Webster, G. D. 01214
Paragassizocrinus calyculoides
Pennsylvanian, U.S., Great Basin, index for upper Morrow: Webster, G. D. 01214
Crust
Deformation
Monitoring, recent studies, U.S. Coast and Geodetic Survey: Whitten, Charles A. 08785
Evolution
Oceanic: Christensen, Nikolas I. 01347
Crystal chemistry
Orthoarsenate
Paragenesis, classification, M:O ratios: Moore, Paul B. 01286
Orthophosphate
Paragenesis, classification, M:O ratios: Moore, Paul B. 01286
Crystal structure
Idocrase
Space groups: Arem, Joel E. 08488
Magadiite
Unit cell, in air and vacuo: Brindley, G. W. 08491
Microcline
Refinement: Bailey, S. W. 08487
Orthoarsenate
Paragenesis, classification, M:O ratios: Moore, Paul B. 01286
Orthophosphate
Paragenesis, classification, M:O ratios: Moore, Paul B. 01286
Ransomite
Structure, proposed classification: Wood, Michael Manning. 01276
Roemerite
Structure, proposed classification: Wood, Michael Manning. 01276
Silicate minerals
Si-O bond length: Brown, G. E. 08486
Cuba
Economic geology
Gold, Guaymaro field, genesis: Maslov, Yu. S. 08804
Metals, occurrence, genesis: Lisitsyn, A. I. 08838
Cystoidea
Tetracystis sp.
Devonian, Tennessee, Birdsong Shale, Decatur County: Smith, Michael Oglesby. 01330
Deformation
Experimental studies
Opposed-anvil high-pressure devices, thermal effects of shear: Calvert, Paul. 08502
Plastic flow, quartz, high temperature, slip systems: Baëta, R. D. 08489
Plastic flow, quartz, high temperature, slip systems: Baëta, R. D. 08490
Field studies
Strain, displacement, California, San Andreas fault: Raleigh, C. B. 08772
Strength, isallo stress analysis, Texas, Alaska: Ranken, R. E. 08612
Stress, shaly rocks, salinity profiles as indicator: Overton, Harold L. 01273
Deltas
Construction
Paleodispersal centers, identification: Long, Sumner. 01324
Gulf Coastal Plain
Mesozoic-Cenozoic systems, facies types, Holocene analogs: Fisher, W. L. 08518
Yukon
Blow River, morphology, sedimentation: McCloy, James Murl. 01184
Devonian
Alaska
East-central, Mollusca, new cricoconarids, zonation: Churkin, Michael, Jr. 08845
Noyes Island, Pteridophytes, graptolitic shale: Churkin, Michael, Jr. 08672
Kansas
Epeirogenic interpretation: Hilpman, Paul L. 01205
Nevada
Central, Brachiopoda, early Middle, zonation, n. spp.: Johnson, J. G. 01211
New York
Hamilton Group, stratigraphy: Cooper, Gustav Arthur. 01230
Western, Portage Group, name abandoned: deWitt, Wallace, Jr. 01308
Saskatchewan
Elk Point salt basin, Winnipegosis Formation: Shearman, D. J. 08763
Tennessee
Decatur County, Birdsong Shale, Cystoidea: Smith, Michael Oglesby. 01330
United States
Midcontinent, eastern, palynology: Norton, Norman J. 01093
Northeastern, midwestern, Tioga Bentonite: Textoris, Daniel A. 01179
Diagenesis
Anhydrite
Nodules in organic laminites, Saskatchewan, Winnipegosis Fm.: Shearman, D. J. 08763
Cementation
Coconino and DeChelly Sandstones, Arizona: Peirce, H. Wesley. 08593

Diagenesis—Continued
Cementation—Continued
Holocene sediments, British Columbia, Fraser River delta: Garrison, Robert E. 08695
Clay minerals
Sedimentary rocks, effects, Oklahoma: Bucke, David Perry, Jr. 01228
Compaction
Carbonate sediments, cf. terrigenous muds: Brown, Philip R. 08847
Diapirs
Arizona
Tucson Mountain Park, fragmental, mechanism: Mayo, Evans B. 08644
Gulf of Mexico
Southern rim, distribution: Weidie, A. E. 08460
Diatomite
Oregon
Occurrence, potential: Wagner, N. S. 08744
Differential thermal analysis
Clay minerals
Quantitative: Davis, C. E. 08702
Methods
Quantitative, Dupont 900 thermal analyzer: Davis, C. E. 08702
Dikes
Clastic
Washington, southeastern, Touchet Beds, permafrost crevices: Alwin, John A. 01193
Dominican Republic
Petrology
San Juan area, limburgite flows, cf. Haiti, south-central: MacDonald, William D. 08818
Earth tides
Observations
California, San Francisco Bay area, ocean tidal loading: Wood, Milton Darroll. 01278
Earthquakes
California
Foci, concentrations, Parkfield aftershocks: Eaton, J. P. 08829
San Andreas fault, recent: Wallace, Robert E. 08771
San Andreas fault system, stress relief: Evans, David M. 08779
Colorado
Denver area, secular strain, mechanism: Major, M. W. 08778
Rocky Mountain Arsenal Well area, pore pressure as cause: Evans, David M. 08779
Detection
Amplitude spectra, distinguishing from explosions: Molnar, Peter. 01298
Distribution
Global tectonics, hypothesis: Sykes, Lynn R. 08780
Elastic waves
P-wave spectral analysis, focal parameters indicator: Kisslinger, Carl. 08786
Experimental studies
Mechanical instabilities, rocks: Brace, W. F. 08830
General
Seismicity, regional, application of photogeology: Slemmons, David B. 08781
Nevada
Microearthquakes, aftershocks and swarms: Ryall, Alan. 08782
Oregon
1969, Aug. 14, North Powder area: Couch, Richard. 08656
Earthquakes—Continued
Periodicity
Time series, spectra: Haubrich, Richard A. 08787
Prediction
Fault movement monitoring, California: Hofmann, Renner B. 08773
Premonitory phenomenon, conference, U.S.-Japan, 1968: Alsop, L. E. 08788
Recent faults, geologic studies: Wallace, Robert E. 08771
Echinodermata
Agelacrinites hybolopus, n. sp.
Pennsylvanian, Middle, Illinois, edrioasteroids: Fraunfelter, G. H. 01215
Ordovician
North America, Middle, primitive: Parsley, Ronald Lee. 01117
Echinoidea
Tertiary
Gulf Coastal Plain, Paleocene-Eocene guide fossils: Toulmin, Lyman D. 08469
Ecology
Anthozoa
Marine, littoral, burrowing anemones, North Carolina: Frey, R. W. 01279
Brachiopoda
Marine, sediment preference, lingulids, cf. Paleozoic: Paine, Robert T. 01378
Foraminifera
Benthonic, marine grass habitat and dispersal: Bock, Wayne D. 08461
Gulf of California
Lagoonal, Laguna Sargento, morphologic units, plant associations: Sherwin, Robert Winslow, Jr. 08584
Gulf of Mexico
Marine benthic, environmental facies, climatic control: Parker, Robert H. 08472
Man
Impact of salt on environment: Martinez, Joseph D. 08523
Mollusca
Bay, lagoon, *Rissoina catesbyana*, paleoecologic indicator: Moore, Donald R. 08466
Pelecypoda
Marine, deposit feeders, key to past: Nicol, David. 08465
Economic geology
Education
University curricula, suggested courses: Behre, Charles H., Jr. 01342
Education
Earth science
Curricula, Maryvale High School, Phoenix, Ariz.: Edgar, Robert A. 08597
Curricula, Ohio State University, teachers: Mayer, Victor J. 01083
Economic geology
Curricula, university level, suggested courses: Behre, Charles H., Jr. 01342
General
Methods, Michigan University, open-scheduled laboratory teaching: Smith, Charles I. 01104
Relevance today: Madeley, Hulon M. 01334
Geology
Curricula, undergraduate, creative approach: Baldwin, Brewster. 01345
Physical, introductory, field laboratories: Cranson, K. R. 01065

Education—Continued
Materials
California, correspondence course text: Webb, Robert W. 08711
Laboratory manual, historical geology: Stewart, John C. 08842
Mining engineering
Nuclear explosions, Pennsylvania State University: Saperstein, L. W. 08668
Oceanography
Deep Sea Drilling Project, raw data, student involvement: Vallier, Tracy L. 01109
Paleontology
Traditional courses, integration with paleoecology: Laporte, Leo F. 01079
Remote-sensing methods
Curricula, Pennsylvania State University: Lattman, Laurence H. 01186
Elastic properties
Anisotropic rocks
Ground stress determination, borehole strain gauge technique: Barla, G. 01292
Rocks
Shock-wave studies: Petersen, Carl Frank. 01246
Electrical methods
Conductance
Hydrogeology, ground-water contribution to storm runoff: Visocky, Adrian P. 01154
Electromagnetic
Rotary field technique: Sinha, Ajit K. 01260
Electrical surveys
Saskatchewan
Southwestern, ground-water study: Dyck, John Henry. 01226
Electron microscopy
Applications
Nannofossil research: Charm, Walter B. 01134
Instruments
Development, history: Inman, Maurice C. 08665
Methods
Development, history: Inman, Maurice C. 08665
Scanning, use with electron probe microanalysis: Radcliffe, Dennis. 01328
Electron paramagnetic resonance
Applications
Conodont dating: Morency, Maurice. 01204
Elements
Geochemistry
Feldspar, coexisting pairs, New York, pegmatite: Schwarzer, Theresa Frances. 01243
Engineering geology
Earthquakes
Ground motion, effect of local geology: Tsai, Nien Chien. 01225
Foundations
Soil settlement, prediction, reliability: Folayan, Joseph Ibikunle. 01224
Geologic hazards
Prevention, role of geologist: Jahns, Richard H. 01343
Highways
Estuary bridge-tunnel, Virginia, Chesapeake Bay mouth, problems: Sverdrup, Leif J. 08674
Land subsidence
Mines, seismo-acoustic measurements: Pomeroy, Paul W. 08784
Land use
Texas Gulf Coast, environmental geologic atlas: Flawn, Peter T. 01383

Engineering geology—Continued
Landslides
Sea coast, wave-height prediction, experimental study: Kuba, Edward M. 08706
Nuclear explosions
Plowshare techniques, teaching, Pennsylvania State University: Saperstein, L. W. 08668
Practice
Environmental geology, training: Bergstrom, Robert E. 01053
Rock mechanics
Ground stress tensor, anisotropic rocks, borehole strain gauge technique: Barla, G. 01292
Shear strength, delta sediments, surface cf. cored, Mississippi: Bryant, William. 08456
Soils
Stress-strain characteristics, linear viscoelastic model: Whitman, Robert V. 01178
Tunnels
Estuary, Maryland, Baltimore Harbor, outer crossing: Fisher, D. H. 08673
Waste disposal
Salt, excess, environmental problems: Martinez, Joseph D. 08523
Tracer test, South Carolina: Webster, D. S. 01370
Epeirogenesis
Devonian
Kansas, interpretation: Hilpman, Paul L. 01205
Erosion
Oregon
Sawtooth Ridge, volcanic crater, differential: Patterson, Peter V. 08652
Rates
Human factor: Gregor, Bryan. 01322
Proportional to mean basin relief: Ahnert, Frank. 08844
Slopes
Rate of development, Alberta, moraines: Welch, D. M. 01188
Submarine canyons
Genesis, off Cape Hatteras, N. C.: Rona, Peter A. 01120
Evaporites
Genesis
Anhydrite nodules in organic laminites, Saskatchewan: Shearman, D. J. 08763
Evolution
Concepts
History, man: Leakey, L. S. B. 08709
Shelf benthos faunas, populations: Valentine, James W. 08670
Conodonts
Carboniferous: Austin, Ronald L. 01189
Carboniferous, Chester-Morrow, western U.S., platform group: Dunn, D. L. 01217
Prioniodid, Ordovician: Bergström, Stig M. 01054
Silurian-Carboniferous, phylogeny, homeomorphic development: Ziegler, Willi. 01115
Silurian-Devonian, New York, New Jersey: Barnett, Stockton G. 01051
Foraminifera
Buliminella groups, n. sp., subsp.: Seiglie, George A. 08819
Mammalia
Dentition, tribosphenic molar, Cretaceous therians cf. opossum: Crompton, A. W. 01269
Origin from therapsids, dentary-squamosal joint: Barghusen, Herbert R. 01206

Explosion phenomena
Experimental studies
Amplitude spectra, distinguishing from explosions: Molnar, Peter. 01298
Seismic array calibration, Northwest Territories: Weichert, D. H. 08613
Faults
Grabens
Alaska, Aleutian Ridge, Buldir Depression: Marlow, M. S. 01376
Low-angle
Grant, Heath, Beaty Canyons faults, Nevada, Grant Range: Hyde, Jack H. 01130
Major
Roselle fault and lineament, Missouri: Gillerman, Elliot. 01169
Mechanism
San Francisco Bay area, Hayward fault: Bolt, Bruce A. 08774
Overthrust
California, Coast Ranges, Nacimiento fault, major structural blocks: Loney, Robert A. 01148
Reverse
General description, Pennsylvania, Hazelton area: Faill, Rodger T. 01255
Strike-slip
California, Hayward-Calaveras zone, creep: Tocher, Don. 08777
California, San Andreas, San Gabriel, post-Oligocene slip: Jahns, Richard H. 08775
California, San Andreas, seismicity: Brune, James N. 08776
California, San Andreas, strain, displacement: Raleigh, C. B. 08772
California, San Andreas system, earthquake foci: Eaton, J. P. 08829
California, San Andreas, tectonics: Wallace, Robert E. 08771
Techniques
Contact zone indicator, vegetation distribution, Utah, Sevier fault: Brooks, William H. 01201
Feldspar
Oregon
Occurrence, potassium: Sheppard, R. A. 08748
Florida
Geomorphology
Alligator Harbor, offshore, subaerially eroded surface, marine modification: Hopkins, E. M. 08468
Blake Plateau, depressions: Stetson, T. R. 08441
Geophysical surveys
Florida Bay and lower keys, gravity: Ball, Mahlon M. 08453
Heat flow
Geothermal gradient: Griffin, G. M. 08526
Paleontology
Protista, Ordovician, north-central, chitinozoans: Andress, Noel E. 08463
Protista, Silurian, well samples, chitinozoans: Goldstein, Robert F. 08525
Sedimentary petrology
Alligator Harbor, offshore sediments, texture, distribution: Hopkins, E. M. 08468
Blake Plateau, sediments, composition, provenance: Stetson, T. R. 08441
Florida Bay, sediments, silicate mineral distribution: Manker, J. P. 08474
Stratigraphy
Tertiary, Cedar Keys Ls., Chipola Fm., Williston Fm., type localities: Welby, Charles W. 08603
Florida—Continued
Structural geology
Northern, Cenozoic uplift, raised shorelines: Hoyt, John H. 08517
Fluorspar
Colorado
Fremont County, Goldie carbonatite, cryolite: Heinrich, E. W. 01074
Folds
Mechanism
Internal folds, Utah, Carmel Fm.: Johnson, Arvid M. 08611
Slump
Identification, Newfoundland, Ordovician: Helwig, James. 01121
Superimposed
Interpretation: Helwig, James. 01121
Foraminifera
Buliminella
Evolution, North and South Amiercan groups, n. sp., subsp.: Seiglie, George A. 08819
Cenozoic
Caribbean, Gulf of Mexico, Mediterranean, Plio-Pleistocene boundary: Lamb, James L. 08553
Deep-sea sediments, biostratigraphy: Berggren, W. A. 08546
Cretaceous-Pleistocene
Atlantic Ocean, deep-sea cores, biostratigraphy: Blow, W. H. 01356
Cretaceous-Quaternary
Atlantic Ocean, deep-sea cores, correlation: Cita, Maria B. 01359
Deep-sea sediments, faunas, biostratigraphy: Blow, W. H. 08539
Cretaceous-Tertiary
Atlantic Ocean, deep-sea cores, larger: Sachs, K. N., Jr. 08540
Ecology
Benthonic, marine grass habitat and dispersal: Bock, Wayne D. 08461
Globorotalia
Miocene-Pleistocene, Jamaica, Coastal Group, coiling directions: Robinson, E. 08479
Globorotalia pertenuis, n. sp.
Pleistocene, Gulf of Mexico, description: Beard, John H. 08552
Globorotalia spp.
Cenozoic, Gulf of Mexico, climate indicators: Beard, John H. 08552
Heterostegina
Oligocene, upper, Tamaulipas, Mexico: Riva Palacio, E. 08684
Lunatriella spinifera, n.gen., n.sp.
Cretaceous, Turonian beds, United States, western interior: Eicher, Don L. 01301
Mesozoic
Bahamas, planktonic, deep-sea cores, biostratigraphy: Pessagno, E. A., Jr. 08547
Morphology
Tests, function: Marszalek, Donald S. 08462
Orbulina
Miocene, tropical vs. temperate, chronologic relation to *G. fohsi*: Bandy, Orville L. 08647
Quaternary
California, Tanner Basin, paleoecology: Kheradpir, Ahmad. 01302
Silurian
Kentucky, Indiana, taxonomic revision: Noland, Anne Vinson. 01116

Foraminifera—Continued
Sphaeroidinellopsis sphaeroides, n. sp.
Pliocene, Gulf of Mexico, Sigsbee Knolls, description: Lamb, James L. 08553
Tertiary
Oregon, Newport area, lists: Snavely, Parke D., Jr. 08649
Fractures
Genesis
Meteoritic impact, associated Precambrian Shield craters, Canada: Zaborski, Jerzy. 08582
Gas, natural
Alberta
Keg River pinnacle reefs, new discovery: Robertson, J. W. 08840
California
Clarksburg field, Pollack and Forbes sands: Lorshbough, A. L. 01254
Cymric field, occurrence: Anderson, David N. 01164
Elk Hills Field, exploration, gravity: Corbató, Charles E. 08577
Northwest San Joaquin field, Nortonville sands: Hill, F. L. 01166
Exploration
Methods, unconventional, symposium: Heroy, William B. 08764
Genesis
Accumulation, effect of ground water, relation to exploration: Rogers, James K. 08440
Kentucky
Central City West quadrangle, occurrence: Palmer, James E. 08832
Lick Creek quadrangle, occurrence: McKay, E. J. 08789
Oregon
Possibilities: Wagner, H. C. 08757
Possibilities, carbon dioxide, soda-water springs: Wagner, N. S. 08799
Pennsylvania
Carmichaels quadrangle, occurrence: Kent, Bion H. 08563
Wyoming
Powder River basin, Hilight field: Tesone, V. P. 01314
Gastropoda
Absolute age
Snail shells, correction for ingested fossil lime: Clark, John W., Jr. 08696
Argobuccinum sp.
Taxonomy, distribution, and phylogeny: Smith, Judith Terry. 01350
Fusitriton sp.
Taxonomy, distribution, and phylogeny: Smith, Judith Terry. 01350
Mediargo sp.
Taxonomy, distribution, and phylogeny: Smith, Judith Terry. 01350
Paleoecology
Snail indicators in archeological sites: Clark, John W., Jr. 08696
Priene sp.
Taxonomy, distribution, and phylogeny: Smith, Judith Terry. 01350
Quaternary
Bermuda, Pleistocene, shell diversity: Gould, Stephen Jay. 01207
Gems
General
Diversity and quantity: Fisher, W. L. 08806
Gems—Continued
Oregon
Occurrence: Mason, R. S. 08794
General
Bibliography
Terrain sciences: Eitel, Dean F. 01135
Education
Curricula, undergraduate, creative approach: Baldwin, Brewster. 01345
Historical literature
Monthly American Journal of Geology and Nat. Sci., 1831-32: Featherstonhaugh, G. W. 08849
Models
Mathematical, geologic processes: Fenner, Peter. 08810
Practice
Environmental geology, training: Bergstrom, Robert E. 01053
Exploration geologist, role in mineral industry decisions: Cameron, Francis. 08807
Geologic hazards, prevention, role of geologist: Jahns, Richard H. 01343
Textbooks
California, correspondence course: Webb, Robert W. 08711
Historical geology, laboratory manual: Stewart, John C. 08842
Mathematical geology: Fenner, Peter. 08810
Geochemical surveys
Alaska
Fortymile area, metals: Foster, Helen L. 01306
New Hampshire
Ossipee Lake quadrangle, heavy metals, citrate-soluble: Cox, Dennis P. 08800
Pennsylvania
Nittany Valley, ground and surface waters: Langmuir, Donald. 08664
Texas
Terlingua district, mercury: Geddes, Richard W. 01232
Washington
Central, soils, properties, seasonal variation: Anderson, T. D. 01194
Geochemistry
Cation exchange
Glaciomarine sediments: Sharma, Ghanshyam D. 01139
Iron-titanium oxides
Manganese fractionation, temperature, fugacity effects: Dasgupta, H. C. 01183
Methods
Automatic data processing, storage and retrieval system: O'Dette, Ralph E. 08513
Mineral Constitution Laboratories, Pennsylvania State Univ.: Bell, Maurice E. 08693
Geochronology
Hydration of glass
Oregon, Newberry Volcano, Holocene flows, obsidian: Peterson, N. V. 08687
Paleomagnetism
Deep-sea cores, preliminary studies: Opdyke, N. D. 08544
Geological exploration
Methods
Mapping, need for more: Cameron, Francis. 08807
Remote sensing, space technology, NASA program: Badgley, Peter C. 08690

Geomorphology
Environment
Arctic, changes, interpretation, permafrost ionic gradients: Brown, Jerry. 08823
Eolian features
Vortex pits, genesis, differential pressure: Whitney, Marion I. 01112
Fluvial features
Channel geometry, bedforms, relation to seepage: Harrison, Samuel S. 01141
Channel response, Georgia, Hiawassee River: Stephenson, Richard A. 01331
Channels, desert streams, cf. lunar rilles: Burke, J. D. 01296
Deltas, Yukon, Blow River: McCloy, James Murl. 01184
Drainage patterns, Arizona, Doney Crater area, Pliocene channel: Breed, William J. 08605
Overland flow hydraulics, erosion, sedimentation: Emmett, William W. 01363
Terraces, modern development, Nevada, Truckee River: Born, Stephen M. 01252
Transport, tracer experiment, Colorado: Kennedy, Vance C. 01294
Valleys, Iowa, southwestern, preglacial: Sendlein, Lyle V. A. 01103
Valleys, Ontario, Niagara escarpment, pre-glacial: White, Owen L. 01111
Glacial features
General, New York, Little Falls-Richfield Springs area: Whipple, Janice M. 01245
General, Yukon, Snag-Klutlan area: Rampton, Vernon Neil. 01242
Till, Michigan, Wisconsin, Valders drift border: Farrand, William R. 01187
Lacustrine features
General, North Dakota, Lake Souris: Moran, Stephen R. 01091
Strand line, chronology, Glacial Great Lakes, New York: Calkin, Parker E. 01384
Landform description
Illinois, Saint Clair County, surficial deposits: Jacobs, Alan M. 01077
Missouri, Roselle lineament: Gillerman, Elliot. 01169
New York, Little Falls-Richfield Springs area: Whipple, Janice M. 01245
Rocky Mountains, Uinta Mountains: Stevens, Dale John. 01227
Landform evolution
Canada, Precambrian shield, tectonic features, meteoritic origin: Zaborski, Jerzy. 08582
Oregon, Lake Oswego area, sequence of events: Parsons, Roger B. 08654
Slope development, rate: Welch, D. M. 01188
Snow-bank kames, genesis and collapse rate, Alaska: McKenzie, G. D. 01352
Yukon, Snag-Klutlan area, Pleistocene: Rampton, Vernon Neil. 01242
Marine features
Continental shelf, sedimentation, graded stages: Swift, Donald J. P. 01377
Erosion, subaerial surface off Florida, modification: Hopkins, E. M. 08468
Ocean depths, remote sensing photographs, Bahama Banks: Ross, D. S. 08689
Submarine canyons, genesis, off Cape Hatteras, N. C.: Rona, Peter A. 01120
Mass movements
Rock glaciers, Wyoming, Absaroka Mts.: Potter, Noel, Jr. 01241

Geomorphology—Continued
Periglacial features
Tundra polygons, North Dakota, southwestern: Clayton, Lee. 01062
Quantitative geomorphology
Beach sand transport, analysis: Boon, John D., 3d. 08662
Michigan, Au Sable, Saginaw drainage basins, hierarchical anomaly: Szucs, F. K. 01106
Mid-Atlantic Ridge, relief features, morphometric analysis: Bogorov, G. V. 08713
Uplift, relief, denudation relations: Ahnert, Frank. 08844
Shore features
Barrier reef, clastic, genesis: McNamee, Donald F. 08433
Beach ridges, raised and modern, Foxe Basin area, N.W.T.: King, C. A. M. 08614
Chenier complex, Louisiana, southeastern: Otvos, Ervin G., Jr. 08473
Terraces, Atlantic Coastal Plain, sea level-tectonic changes: Richards, Horace G. 08481
Tidal inlets, washover fans, storm surge genesis: Pierce, J. W. 01125
Transport, beach sand, quantitative analysis: Boon, John D., 3d. 08662
Geophysical methods
Interpretation
Automatic data processing, time sharing in mining geophysics: Halverson, Mark O. 08505
Geophysical surveys
Mexico
Veracruz, Poza Rica district, basement relief: Bello Orta, G. 08630
Geophysics
Methods
Automatic data processing, Dirichlet and Poisson problems solution: Sturgul, J. R. 08506
Georgia
Absolute age
Charlton County, Okefenokee Swamp, peat, C-14: Bond, T. A. 01380
Geomorphology
Northern, Hiawassee River, channel response: Stephenson, Richard A. 01331
Piedmont, sedimentation, culturally-accelerated: Trimble, Stanley W. 01332
Geophysical surveys
Jasper County, Gladesville Norite, gravity: Carpenter, Robert H. 01319
Heat flow
Geothermal gradient, southern: Griffin, G. M. 08526
Mineralogy
Habersham County, ruby-bearing nodules, spectrography: Giardini, A. A. 01321
Paleontology
Mammalia, Quaternary, northwestern, porcupine, distribution: Ray, Clayton E. 01329
Palynomorphs, Quaternary, Okefenokee Swamp: Bond, T. A. 01380
Sedimentary petrology
Jackson County, magnetite-bearing quartzite: Hughes, Thomas C. 01323
Lookout Valley, Sequatchie Fm., oolite: Chowns, T. M. 01320
Northwestern, Chickamauga Supergroup, bentonites: Martin, B. F. 01326
Sapelo Island, barrier island facies, X-ray radiography: Howard, James D. 08447
Stratigraphy
Pleistocene, Penholoway Fm., Wayne County, type locality: Welby, Charles W. 08603

Geothermal energy
Oregon
Klamath and Lake Counties, possibilities: Godwin, L. H. 08758
Glaciation
Correlation
United States and New Zealand, Pleistocene stages: Powers, William E. 01124
Deglaciation
Isostatic uplift, Northwest Territories, Baffin Island: Andrews, J. T. 01251
Glaciers
Greenland
Central, accumulation, deformation, mass balance, temperature: deQuervain, Marcel. 08841
Western, radio-echo sounding, airborne: Gudmandsen, P. 08769
Ice
Thickness determination, radio-echo sounding: Harland, Brian. 08700
Thickness, radio-echo sounding, Greenland: Gudmandsen, P. 08769
Northwest Territories
Ellesmere Island, radio-echo sounding: Hattersley-Smith, G. 08701
Gold
Abundance
Water, plants, and animals: Jones, Robert S. 01315
Cuba
Guaymaro field, genesis: Maslov, Yu. S. 08804
Oregon
Blue Mountains and western, occurrence, potential: Brooks, H. C. 08732
Graptolithina
Ordovician
Michigan, Rapid City area, correlation, Eden age: Berry, William B. N. 01213
Gravel
Massachusetts
Georgetown quadrangle, occurrence: Cuppels, Norman P. 08792
Oregon
Resources: Schlicker, H. G. 08750
Gravity field, Earth
Networks
California Base Station Network, progress report: Chapman, Rodger H. 08574
Montana, base station, 1963: Smith, Robert B. 08571
U.S. National Gravity Base Net: Schwimmer, Philip M. 08569
Gravity methods
Instruments
Gravimeter calibration, standardization, U.S. Geol. Survey: Barnes, David F. 08570
Pendulum apparatus, Dominion Observatory, Canada: Valliant, H. D. 08568
Interpretation
Interlocking profile network method, regional density change correction: Fagg, Clint F. 08442
Gravity surveys
Alaska
U.S. Geol. Survey map program, progress report: Barnes, David F. 08579
Arizona
Summary, program since 1965: Sumner, J. S. 08599
Gravity surveys—Continued
California
Division of Mines and Geology program: Chapman, Rodger H. 08574
Elk Hills oil field, progress report: Corbató, Charles E. 08577
Transverse Range Province, recent work, summary: Rietman, Jan D. 08576
U.S. Geol. Survey cooperative program, since 1963: Oliver, Howard W. 08575
Colorado
Aspen area, Wyoming Univ. studies: Smithson, Scott B. 08573
Florida
Southern, bay and lower keys: Ball, Mahlon M. 08453
Georgia
Jasper County, Gladesville Norite: Carpenter, Robert H. 01319
Idaho
Soda Springs region: Mabey, Don R. 01163
Mexico
Yucatán, petroleum exploration: Oñate Espinosa, R. 08680
Yucatán platform, western, application: Morales Reyna, M. 08637
Michigan
Kalamazoo County, bedrock topography: Ibrahim, Abdelwahid. 01076
Montana
Boulder and Tobacco Root batholiths: Burfeind, Walter J. 08572
Princeton University program, since 1965: Bonini, William E. 08600
Western, central, 1963 regional: Smith, Robert B. 08571
North America
Western, coastal and offshore, Oregon State Univ. program: Couch, R. W. 08578
Western, general, symposium: Barnes, David F. 08567
Pacific Ocean
Aleutian trench, crustal studies: Malahoff, Alexander. 08581
United States
Western, U.S. Geol. Survey, since 1964: Kleinkopf, M. Dean. 08601
Utah
Summary, published and unpublished data: Cook, Kenneth L. 08598
Washington
Western, University of Washington program: Christensen, Nikolas I. 08580
Wyoming
Princeton University program, since 1965: Bonini, William E. 08600
Wyoming Univ. program, summary: Smithson, Scott B. 08573
Great Lakes region
Sedimentary petrology
Lake Michigan, southwestern, sediments: Collinson, Charles. 01064
Greenland
Geomorphology
West, shelf, marginal channels, glacial origin: Holtedahl, Olaf. 01386
Geophysical surveys
Western, radio-echo sounding of ice sheet, airborne: Gudmandsen, P. 08769
Glacial geology
Central, snow research, 1959-60: deQuervain, Marcel. 08841

Ground water
Appalachians
Resources, summary: Wyrick, Granville G. 08848
Arizona
Composition, Gila River valley, alluvium and fill, variance: Laney, R. L. 01152
Geochemistry, hydrodynamics, travertine formation, Montezuma well: Cole, Gerald A. 08607
Movement, level changes, Gila River valley, observation-well network: Myrick, R. M. 01253
Hawaii
Exploration, basaltic aquifers, electrical logging: Peterson, Frank L. 01155
Illinois
Movement, Panther Creek basin, contribution to storm runoff: Visocky, Adrian P. 01154
Resources, Illinois Valley, middle, Pleistocene deposits: McComas, Murray Ratcliffe. 01238
Kentucky
Occurrence, variables, Centerville quadrangle, limestone: Johnson, John T. 01176
Nevada
Levels, Nevada Test Site, deep aquifers, measurement, factors affecting: Winograd, Isaac J. 01156
New York
Contamination, Suffolk County, southwestern: Perlmutter, N. M. 01263
Ohio
Resources, Akron area, development: Rau, Jon L. 01099
Oregon
Resources: Phillips, K. N. 08759
Resources: U.S. Geological Survey. 08715
Pennsylvania
Composition, Nittany Valley: Langmuir, Donald. 08664
Texas
Resources, Angelina-Nacogdoches Counties: Guyton, William F., and Associates. 01368
Resources, Bastrop County: Follett, C. R. 01256
United States
Levels, northeastern, 1963-67: U.S. Geological Survey. 01262
Washington
Composition, thermal springs: Campbell, K. Vincent. 01190
Resources, King County: Luzier, J. E. 08833
Wisconsin
Resources and quality, Rock-Fox River basin: Cotter, R. D. 08765

Gulf Coastal Plain
Economic geology
Petroleum, exploration, significance of Pliocene biostratigraphy: Leutze, W. P. 08471
Paleontology
Mollusca, Echinoidea, Paleocene-Eocene, guide fossils: Toulmin, Lyman D. 08469
Sedimentary petrology
Gulf Coast basin delta systems, facies types, Holocene analogs: Fisher, W. L. 08518
Stratigraphy
Paleocene-Eocene, biostratigraphy, guide fossils: Toulmin, Lyman D. 08469
Quaternary, depositional episodes, relation to sea-level changes: Frazier, David E. 08482
Tertiary, biostratigraphy, significance of Pliocene: Leutze, W. P. 08471

Gulf of California
Geomorphology
Laguna Sargento, lagoonal features, plant associations: Sherwin, Robert Winslow, Jr. 08584

Gulf of Mexico
Economic geology
Petroleum, genesis in deep-sea sediments, upward movement: Rezak, Richard. 08439
Petroleum, possible future provinces, western basin: Mason, B. B. 08448
Geochemistry
Deep Sea Drilling Project, core samples, interstitial water: Kaplan, I. R. 08543
Deep Sea Drilling Project, Leg 1, core samples, interstitial water: Manheim, F. T. 08542
Pleistocene sediments, organic matter, C-13:C-12, climate correlation: Rogers, M. A. 08478
Water, uranium, abundance, isotopic composition: Sackett, W. M. 08519
Geomorphology
Northwestern, Flower Garden Banks, genesis: Levert, Charles F., Jr. 08437
Geophysical surveys
North Florida Platform, seismic: Antoine, John W. 08449
Sigsbee deep, well logging: Kennedy, K. F. 08604
Mineralogy
General, deep-sea sediments, X-ray data: Rex, R. W. 08537
Paleoclimatology
Quaternary, Foraminifera as indicators: Beard, John H. 08552
Tertiary-Pleistocene, northern: Elsik, William C. 08551
Paleontology
Foraminifera, Cenozoic, deep-sea cores, biostratigraphy: Berggren, W. A. 08546
Foraminifera, Cretaceous-Pleistocene, deep-sea cores, biostratigraphy: Blow, W. H. 08539
Foraminifera, Pliocene-Pleistocene, boundary datums, cf. Italy: Lamb, James L. 08553
Foraminifera, Quaternary, northern, climate indicators: Beard, John H. 08552
Palynomorphs, Neogene, northern, paleoclimatology: Elsik, William C. 08551
Protista, Cretaceous-Pleistocene, deep-sea cores, nannoplankton: Hay, W. W. 08538
Protista, Pliocene-Pleistocene, deep-sea cores: Bukry, David. 08548
Radiolaria, Tertiary, deep-sea cores: Riedel, W. R. 08541
Sedimentary petrology
Sediments, deep-sea cores: Beall, A. O., Jr. 08545
Selected cores, sediment distribution map, application: Bouma, Arnold H. 08444
Sigsbee deep, cores: Ewing, M. 08532
Sigsbee deep, cores, carbon and carbonate contents: Deep Sea Drilling Project. 08535
Sigsbee deep, cores, water content: Deep Sea Drilling Project. 08534
Structural geology
Southern rim, effects of major orogenies: Weidie, A. E. 08460

Gymnosperms
Pinus aristata
Pleistocene, California, Clark Mtn. midden site, pluvial occurrence: Mehringer, Peter J., Jr. 08608

Gymnosperms—Continued
Quaternary
California, Pleistocene-Holocene montane assemblages, Mojave Desert: Mehringer, Peter J., Jr. 08608
Nevada, Pleistocene, woodrat middens, elevation changes: Leskinen, Paul. 08585
Taxodiaceae
Cretaceous, Alberta, Edmonton Fm., n. spp.: Ramanujam, C. G. K. 08767
Gypsum
Oregon
Resources: Wagner, N. S. 08745
Hawaii
Areal geology
Kau Desert quadrangle: Walker, George W. 08676
Geophysical surveys
Basaltic aquifers, electrical logging, interpretation: Peterson, Frank L. 01155
Oregon State University gravity program: Couch, R. W. 08578
Hydrogeology
Basaltic aquifers, exploration, electrical logging: Peterson, Frank L. 01155
Maps, geologic
Kau Desert quadrangle: Walker, George W. 08676
Petrology
Hualalai Volcano, pillow lavas, palagonitization: Moore, James G. 01182
Heat flow
Geothermal gradient
Florida, Georgia: Griffin, G. M. 08526
Heavy minerals
Oregon
Sixes River, sand-size materials in gravel bars: Boggs, Sam, Jr. 08650
Southwestern, black sands, production history, occurrence: Clifton, H. E. 08834
Helium
Geochemistry
Rocks, minerals, generation: Esfandiari, Bijan. 01247
Solution in surface- and seawater, isotope effect: Weiss, R. F. 01290
Isotopes
He-3, He-4, solubilities in water: Weiss, R. F. 01290
History
Evolution
Man, concepts: Leakey, L. S. B. 08709
Geology
Early travelers' observations, United States, 1750-87, midwestern: White, George W. 08760
Monthly American Jour. Geology and Nat. Sci.
1831-32 facsimile edition: Featherstonhaugh, G. W. 08849
Society Econ. Paleontologists and Mineralogists
1926-46: Russell, R. Dana. 01209
Texas
Geology and politics, 1845-1909: Ferguson, Walter Keene. 08825
Honduras
Maps, geologic
Nueva Armenia area: Honduras Instituto Geográfico Nac. 01158
San Buenaventura area: Honduras Instituto Geográfico Nac. 01160
Tegucigalpa area: Honduras Instituto Geográfico Nac. 01159
Honduras—Continued
Stratigraphy
Cretaceous-Quaternary, Tegucigalpa area: Honduras Instituto Geográfico Nac. 01159
Volcanology
History, since Paleozoic: Williams, Howel. 08708
Hydrogeology
Experimental studies
Aquifer models, partially penetrating rivers, simulation: Herbert, Robin. 01157
Exploration methods
Geothermal: Birman, J. H. 01142
Geothermal, term questioned: Cartwright, Keros. 01143
Geochemistry
Water quality, relation to sediments: Grissinger, E. H. 01375
Ground-water movement
Contribution to storm runoff, electrical conductance method: Visocky, Adrian P. 01154
Level changes, Arizona, Gila River valley, observation-well network: Myrick, R. M. 01253
Mathematical models
Fluid dispersion, tritium tracer test, fractured crystalline rock: Webster, D. S. 01370
Methods
Comparative, classification of settings for processes: LeGrand, Harry E. 01149
Electrical resistivity, aquifer evaluation: Dyck, John Henry. 01226
Processes
Comparative, United States, southeastern, classification of settings: LeGrand, Harry E. 01149
Resource development
Arid regions, phreatophyte control, Arizona, Gila River project: Culler, R. C. 01150
National water atlas, proposal: Heindl, L. A. 01379
Hydrothermal alteration
Oregon
Mitchell area, mudstones, Tertiary intrusions: Jarman, Clara. 01197
Sixes and Pistol Rivers area, intrusions: Lund, Ernest H. 08655
Ice, nonglacial
Sea-ice features
Remote sensing techniques: McLerran, James H. 08770
Idaho
Geophysical surveys
Soda Springs region, gravity, magnetic: Mabey, Don R. 01163
Maps, geologic
Mackay quadrangle: Nelson, Willis H. 08801
Soda Springs region: Mabey, Don R. 01163
Maps, gravity
Soda Springs region: Mabey, Don R. 01163
Maps, magnetic
Soda Springs region: Mabey, Don R. 01163
Petrology
Craters of the Moon National Monument, basalt, blue glass: Miller, Roy M. 01090
Sedimentary petrology
Snake River Canyon, Triassic conglomerates, granitic clasts: Vallier, Tracy L. 01110
Igneous rocks
Basalt
Alteration, palagonitization, pillow lava, Hawaii: Moore, James G. 01182

Igneous rocks—Continued
Basalt—Continued
General description, blue glass, Idaho: Miller, Roy M. 01090
Physical properties, rheology in melting range: Shaw, Herbert R. 08566
Carbonatite
Mineral composition, Colorado, Fremont County, cryolite: Heinrich, E. W. 01074
Petrology, Quebec, Oka carbonatite, zoned micas and silicates: Rimsaite, Jadvyga. 08660
Classification
CORFAN-FORTRAN IV computer program: Ondrick, C. W. 01362
Differentiation
Minnesota, Cook County, Duluth complex: Nathan, Harold Decantillon. 01240
General
Petrology, Maryland, Harford County: Southwick, David L. 08837
Petrology, Nevada, Buffalo Mtn. pluton: Neff, Thomas Rodney. 01275
Petrology, Oregon, Greyback intrusive complex: Godchaux, Martha Miller. 01235
Geochemistry
New York, Adirondack Mts., anorthosite-charnockite, element variation: Crosby, Percy. 01066
Limburgite
Dominican Republic, analyses, cf. Haiti, south-central: MacDonald, William D. 08818
Pegmatite
Textures, poikilitic albites in microcline, genesis: Fisher, D. Jerome. 08595
Porphyry
Textures, intrusions, nonporphyritic selvages, origin: Lund, Ernest H. 01199
Tholeiite
General description, Atlantic Ocean, Mid-Atlantic Ridge, cores: Engel, A. E. J. 01358
Volcanic ash
Genesis, properties, significance, ash flows: Peterson, Donald W. 01341
Physical properties, Kansas, Calvert ash, cf. Pearlette: Bauleke, Maynard P. 01203
Volcanics
Differentiation, Arizona, Black Mesa caldera, basanite lava: Sheridan, Michael F. 08596
General description, base surge density flows, maar volcanoes: Fisher, Richard V. 01177
General description, Oregon, Cedar Butte area: Nelson, Dennis O. 08686
Illinois
Geomorphology
Saint Clair County, surficial deposits: Jacobs, Alan M. 01077
Geophysical surveys
Mississippi River, bedrock channel, ancient, seismic: McGinnis, L. D. 01084
Hydrogeology
Illinois Valley, middle, ground-water resources: McComas, Murray Ratcliffe. 01238
Panther Creek basin, ground-water contribution to storm runoff: Visocky, Adrian P. 01154
Paleontology
Echinodermata, Pennsylvanian, Middle, edrioasteroids, n. sp.: Fraunfelter, G. H. 01215
Sedimentary petrology
Salem, Saint Louis Limestones, lithofacies: Lineback, Jerry A. 01081
Stratigraphy
Cambrian: Buschbach, Thomas C. 01058
Indiana
Absolute age
Lake Chicago sediments, Glenwood stage, C-14: Schneider, Allan F. 01102
Economic geology
Petroleum, development, production, 1968: Carpenter, G. L. 08707
Paleontology
Foraminifera, Silurian, southeastern, revision: Noland, Anne Vinson. 01116
Stratigraphy
Cambrian, subsurface: Becker, Leroy E. 01052
Industrial minerals
General
Diversity and quantity: Fisher, W. L. 08806
Mexico
San Luis Potosí, Huizache-Vallejo area, celestite, occurrence: Velasco Arellano, Abraham. 08648
Oregon
Central and southeastern, occurrence: Sheppard, R. A. 08754
Occurrence, potential: Wagner, N. S. 08798
Infrared methods
Techniques
Airborne photography, sedimentary processes: Levy, John S. 01172
Insects
Phylloxeridae
Tertiary, Arkansas, Wilcox Fm., plant galls: Wittlake, Eugene B. 08768
Intrusions
Mechanism
Tuffisite diapir, Arizona, Tucson Mtn. Park: Mayo, Evans B. 08644
Minnesota
Cook County, Duluth complex, differentiation: Nathan, Harold Decantillon. 01240
Nevada
Buffalo Mountain pluton, petrology: Neff, Thomas Rodney. 01275
Oregon
Klamath Mountains, Greyback complex: Godchaux, Martha Miller. 01235
Mitchell area, alteration of mudstones, Tertiary: Jarman, Clara. 01197
Iowa
Geomorphology
Southwestern, preglacial bedrock valleys: Sendlein, Lyle V. A. 01103
Iron
Canada
Labrador Trough, exploration, geophysical, interpretation methods: Seguin, Maurice K. 01317
Oregon
Occurrence: Mason, R. S. 08733
Isostasy
Northwest Territories
Baffin Island, glacial rebound: Andrews, J. T. 01251
Isotopes
Argon
Pillow basalt, Ar-40 excess: Dymond, Jack. 01136
Carbon
Pleistocene sediments, organic matter, Gulf of Mexico: Rogers, M. A. 08478
Helium
Solubility in water, He-3, He-4: Weiss, R. F. 01290

Isotopes—Continued
Oxygen
Fractionation, foraminifera, paleotemperature, value questioned: Duplessy, J. C. 01289
Uranium
Ratios, Gulf of Mexico, waters: Sackett, W. M. 08519
Jamaica
Paleontology
Foraminifera, Miocene-Pleistocene, Coastal Group, coiling directions: Robinson, E. 08479
Jurassic
Arkansas
Upper, stratigraphy, depositional environments: Dickinson, Kendell A. 08522
Atlantic Ocean
Blake-Bahama basin, Bermuda rise, coccolith biostratigraphy: Bukry, David. 08548
Louisiana
Upper, stratigraphy, depositional environments: Dickinson, Kendell A. 08522
Oregon
Chetco River, Pelecypoda, Dothan(?) Fm., age: Ramp, Len. 08657
Texas
Upper, stratigraphy, depositional environments: Dickinson, Kendell A. 08522
Kansas
Economic geology
Ceramic materials, Calvert volcanic ash, properties, cf. Pearlette: Bauleke, Maynard P. 01203
Mineralogy
Epsomite, hexahydrite, Atchison area, underground storage area: Tien, Pei-lin. 01202
Paleontology
Foraminifera, Cretaceous, Turonian beds, new heterohelicid: Eicher, Don L. 01301
Mollusca, Quaternary, Sandahl fauna, McPherson County: Miller, Barry B. 01372
Stratigraphy
Devonian, epeirogenic interpretation: Hilpman, Paul L. 01205
Pleistocene, loess deposits, northeastern: Caspall, Fred C. 01060
Pleistocene, surficial deposits, Doniphan County: Dort, Wakefield, Jr. 01070
Kentucky
Economic geology
Coal, Jellico West (Tenn.) quadrangle, beds: Englund, Kenneth J. 08793
Coal, natural gas, Lick Creek quadrangle, occurrence: McKay, E. J. 08789
Coal, petroleum, natural gas, Central City West quadrangle: Palmer, James E. 08832
Hydrogeology
Centerville quadrangle, limestone, ground-water occurrence, variables: Johnson, John T. 01176
Maps, geologic
Buckeye quadrangle: Wolcott, Don E. 01281
Central City West quadrangle: Palmer, James E. 08832
Jellico West (Tenn.) quadrangle: Englund, Kenneth J. 08793
Lick Creek quadrangle: McKay, E. J. 08789
Paleontology
Foraminifera, Silurian, north-central, revision: Noland, Anne Vinson. 01116
Sedimentary petrology
Eastern, Breathitt Fm., Magoffin Beds, environments: Outerbridge, W. F. 01174
Kentucky—Continued
Stratigraphy
Mississippian, Chester Series, western: Calvert, Ronald Harold. 01229
Ordovician, Drakes Fm., Bardstown Member, central: Peterson, Warren L. 01312
Ordovician-Pennsylvanian, Jellico West (Tenn.) quadrangle, section: Englund, Kenneth J. 08793
Pennsylvanian, Cenozoic, Central City West quadrangle, section: Palmer, James E. 08832
Labrador
Economic geology
Magnetite, Smallwood mine, formation mode, distribution, factor analysis: Zodrow, Erwin L. 01318
Lakes
Florida
Mud Lake, analog of Green River oil-shale precursors: Bradley, W. H. 01250
Lakes, extinct
Indiana
Lake Chicago, sediments, absolute age: Schneider, Allan F. 01102
New York
Northwestern, Glacial Great Lakes, chronology: Calkin, Parker E. 01384
North Dakota
Lake Souris, landforms: Moran, Stephen R. 01091
Lead
Missouri
Southeastern, control by Roselle lineament: Gillerman, Elliot. 01169
Oregon
Occurrence, potential: Bowen, R. G. 08731
Limestone
Pennsylvania
Carmichaels quadrangle, occurrence: Kent, Bion H. 08563
Mather quadrangle, occurrence: Kent, Bion H. 08790
Tennessee
Baileyton quadrangle, occurrence: Finlayson, C. Pratt. 08554
Cumberland Springs quadrangle, occurrence: Wilson, Charles W., Jr. 08557
Welchland quadrangle, occurrence: Garman, R. Keith. 08559
Lineaments
Missouri
Southeastern, Roselle lineament: Gillerman, Elliot. 01169
Lithium
California
Searles Lake, production from brine: O'Neill, Bernard J. 08663
Nevada
Clayton Valley, brines: O'Neill, Bernard J. 08663
North Carolina
Kings Mountain area, pegmatite, occurrence: O'Neill, Bernard J. 08663
Occurrence
Pegmatites, brines: O'Neill, Bernard J. 08663
Louisiana
Economic geology
Petroleum, Bay Marchand-Timbalier Bay-Caillou Island salt complex: Frey, M. G. 08454
Petroleum, Southwest Lake Arthur field, geology, geophysics, integration: Gotautas, Vito A. 08455

Louisiana—Continued
Geomorphology
Southeastern, Moreau-Caminada chenier, evolution: Otvos, Ervin G., Jr. 08473
Paleontology
Cephalopoda, Eocene, Jackson fm., Montgomery: Gimbrede, Louis de A. 08477
Vertebrata, list, bibliography, index: Domning, Daryl P. 08464
Sedimentary petrology
Southeastern, Moreau-Caminada chenier complex: Otvos, Ervin G., Jr. 08473
Stratigraphy
Cretaceous, Glen Rose reef complex: McNamee, Donald F. 08433
Jurassic, Upper: Dickinson, Kendell A. 08522
Magmas
Genesis
Thermodynamic mechanisms, experimental study: Shaw, Herbert R. 08566
Magnetic methods
Instruments
Magnetometer array, California, San Andreas fault, progress: Kovach, Robert L. 08783
Interpretation
Aeromagnetic data, power spectrum, statistical models: Spector, A. 01259
Aeromagnetic field, statistical structure: Naidu, Prabhakar S. 01258
Magnetic surveys
Idaho
Soda Springs region: Mabey, Don R. 01163
Magnetite
Labrador
Smallwood mine, formation mode, distribution, factor analysis: Zodrow, Erwin L. 01318
Major-element analyses
Bindheimite
Bismuthian, Utah, Eureka: Montoya, J. 08500
Caliche
New Mexico, high plains: Aristarain, L. F. 01123
Connate water
Deep-sea sediments, Atlantic Ocean: Kaplan, I. R. 01357
Ground water
New York, Suffolk County, southwestern: Perlmutter, N. M. 01263
Texas, Angelina-Nacogdoches Counties: Guyton, William F., and Associates. 01368
Texas, Bastrop County: Follett, C. R. 01256
Wisconsin, Rock-Fox River basin: Cotter, R. D. 08765
Ruby-bearing nodules
Georgia, Habersham County, emission spectroscopy: Giardini, A. A. 01321
Sediments
Deep-sea, core samples, interstitial water: Kaplan, I. R. 08543
Silicate rocks
Standard samples, spectroscopy, atomic-absorption: VanLoon, J. C. 08610
Mammalia
Basilosaurus cetoides
Eocene, Mississippi, collecting: Applegate, Shelton P. 01274
Didelphis marsupialis
Holocene, molar occlusion, chewing cycle, cf. Cretaceous therians: Crompton, A. W. 01269
Erethizon dorsatum
Quaternary, United States, eastern, distribution: Ray, Clayton E. 01329

Mammalia—Continued
Evolution
Origin from therapsids, dentary-squamosal joint: Barghusen, Herbert R. 01206
Mammuthus
Quaternary, Arizona, late Pleistocene distribution: Saunders, Jeffrey J. 08592
Quaternary, Washington, Touchet Beds, Horse Heaven Plateau: Newcomb, R. C. 01192
Mammuthus (Parelephas) columbi
Pliocene-Pleistocene, Arizona, San Pedro Valley: Hemmings, E. Thomas. 08606
Morphology
Jaw function mechanism, opossum cf. Cretaceous therians: Crompton, A. W. 01269
Platygonus compressus
Quaternary, Arkansas, Peccary Cave, biostratigraphy: Davis, Leo Carson. 08698
Tertiary
Utah, Green River Fm., Eocene: Parker, Lee R. 01095
Man, fossil
Evolution
Concepts, history: Leakey, L. S. B. 08709
Manganese
Geochemistry
Arctic Ocean sediments, migration: Li, Yuan-Hui. 08850
Fractionation, iron-titanium oxides: Dasgupta, H. C. 01183
Oregon
Resources: Appling, R. N., Jr. 08734
Manitoba
Absolute age
Southern, Holocene lake sediment, C-14: Ritchie, J. C. 08766
Paleontology
Palynology, Holocene, lake sediment, Riding Mtn. area, frequencies: Ritchie, J. C. 08766
Petrology
West Hawk Lake meteor crater, cores, shock features: Short, Nicholas M. 01170
Stratigraphy
Ordovician-Silurian, northern, biostratigraphy: Norford, B. S. 01133
Mantle
Experimental studies
Shock-wave studies, selected rocks: Petersen, Carl Frank. 01246
Marine geology
Bottom features
Abyssal plains, genesis, turbidity current deposition: Conolly, John R. 08550
Depressions, Blake Plateau off Florida: Stetson, T. R. 08441
Mid-Atlantic Ridge, morphometric analysis: Bogorov, G. V. 08713
Submarine canyon, Atlantic Ocean, Great Bahama: Andrews, James E. 01138
Submarine canyons, genesis, off Cape Hatteras, N. C.: Rona, Peter A. 01120
Instruments
Piston corer, self-deactivating piston: Woodruff, James L. 01261
Methods
Paleomagnetic stratigraphy, evaluation: Watkins, N. D. 08483
Seismic profiling systems, advances: Luehrmann, William H. 08803

Marine geology – Continued
Sediments
Atlantic Ocean, Deep Sea Drilling Project, Leg 2: Peterson, Melvin N. A. 01268
Atlantic Ocean, Deep Sea Drilling Project, Leg 2, summary: Peterson, M. N. A. 01360
Carbon and carbonate content, Deep Sea Drilling Project, Leg 1: Deep Sea Drilling Project. 08535
Composition, Blake Plateau depressions off Florida: Stetson, T. R. 08441
Composition, water, Deep Sea Drilling Project, Leg 1: Deep Sea Drilling Project. 08534
Grain-size analysis, methods, Deep Sea Drilling Project, Leg 1: Deep Sea Drilling Project. 08533
Methods, electric logging vs. other physical property studies: Chmelik, Frank B. 08435
Mineralogy, X-ray diffraction analyses, Deep Sea Drilling Project, Leg 1: Rex, R. W. 08537
Pacific Ocean, Cascadia Basin, clay mineralogy, provenance: Duncan, John R. 01122
Sedimentology, Deep Sea Drilling Project, Leg 1: Beall, A. O., Jr. 08545
Thin-section data, Deep Sea Drilling Project, Leg 1: Wood, G. V. 08536
Well logging, Deep Sea Drilling Project, Leg 1: Kennedy, K. F. 08604
Maryland
Areal geology
Great Falls area, guidebook: U.S. Geological Survey. 01153
Economic geology
Construction materials, dunite, Montgomery County: Larrabee, David M. 08564
Construction materials, other mineral resources, Harford County: Edwards, Jonathan, Jr. 08828
Engineering geology
Tunnels, Baltimore Harbor, outer crossing: Fisher, D. H. 08673
Maps, geologic
Harford County: Owens, James P. 08827
Harford County: Southwick, David L. 08837
Hunting Hill serpentinite quarry: Larrabee, David M. 08564
Maps, mineral resources
Harford County: Edwards, Jonathan, Jr. 08828
Petrology
Harford County, Piedmont, Precambrian-Ordovician, units: Southwick, David L. 08837
Montgomery County, Hunting Hill quarry, serpentinite, rodingite: Larrabee, David M. 08564
Sedimentary petrology
Harford County coastal plain, Potomac Group, gravels: Owens, James P. 08827
Stratigraphy
Cretaceous-Cenozoic, Potomac Group, Harford County: Owens, James P. 08827
Structural geology
Harford County, Piedmont area: Southwick, David L. 08837
Massachusetts
Economic geology
Gravel, Georgetown quadrangle: Cuppels, Norman P. 08792
Glacial geology
Georgetown quadrangle: Cuppels, Norman P. 08792
Massachusetts – Continued
Maps, geologic
Georgetown quadrangle, surficial: Cuppels, Norman P. 08792
Mercury
Oregon
Occurrence, production history: Brooks, H. C. 08735
Texas
Terlingua district, geochemical prospecting: Geddes, Richard W. 01232
Mesozoic
Bahamas
Deep-sea cores, Foraminifera and Radiolaria, biostratigraphy: Pessagno, E. A., Jr. 08547
Gulf Coastal Plain
Gulf Coast basin delta systems, Holocene analogs: Fisher, W. L. 08518
Mexico
Chiapas, stratigraphy, paleogeography: Sánchez Montes de Oca, R. 08636
Metals
Alaska
Fortymile area, exploration: Foster, Helen L. 01306
Cuba
Genesis, distribution: Lisitsyn, A. I. 08838
Oregon
Blue Mountains, general: Thayer, T. P. 08721
Production history: Weissenborn, A. E. 08726
South Dakota
Galena-Roubaix district, exploration: Bayley, R. W. 01374
Metamorphic rocks
General
Petrology, Maryland, Harford County, Piedmont: Southwick, David L. 08837
Petrology, Montana, Beartooth Mts., Hellroaring Lakes area: Rowan, Lawrence C. 01180
Gneiss
Absolute age, geochemistry, genesis, Twilight Gneiss, Colorado: Barker, Fred. 08658
Metasediments
Absolute age, Ontario, Gunflint Fm.: Misra, A. 01185
Mineral assemblages
California, Franciscan Fm., data, phases, physical properties: Seki, Y. 08714
Mineral facies
California, Franciscan rocks, P-T conditions: Suppe, John Edward. 01244
Greenschist, zoned garnet: Brown, Edwin H. 08498
Incipient, recognition in mudrock, state of organic matter: Baker, Donald R. 01127
Oregon, Greyback intrusive complex, contact aureole: Godchaux, Martha Miller. 01235
Rodingite
General description, Maryland, Montgomery County: Larrabee, David M. 08564
Serpentinite
General description, Maryland, Montgomery County: Larrabee, David M. 08564
Metamorphism
Incipient
Effects on organic matter in mudrock: Baker, Donald R. 01127
Regional
Colorado, Nederland quadrangle: Gable, Dolores J. 08791
Paleozoic rocks, Nevada, Grant Range, central: Hyde, Jack H. 01130

Metamorphism – Continued
Shock
Manitoba, West Hawk Lake, cataclasis, meteor impact: Short, Nicholas M. 01170
Meteor craters
Manitoba
West Hawk Lake, drill core, petrography: Short, Nicholas M. 01170
Meteorites
Allende
Composition, cordierite, first meteoritic occurrence: Fuchs, Louis H. 08496
Canyon Diablo
Composition, Arizona, Camp Verde specimens: Lewis, Charles F. 08589
Composition
Brezinaite, new mineral, Tucson meteorite: Bunch, T. E. 08485
Chondrites, microchondrules: Levi-Donati, G. R. 01284
Cordierite, first meteoritic occurrence, Allende: Fuchs, Louis H. 08496
Mineral: Wickman, Frans E. 08666
Genesis
Enstatite chondrites, high-temperature, reducing conditions: Fredrikson, K. 08761
Geochemistry
Iron, electrolytic corrosion, experimental: Tackett, Stanford L. 01283
Holbrook
New specimen, description: Gibson, Everett K., Jr. 01285
Seymour
Mineralogical relations: Drake, John C. 01282
Tucson
Composition, brezinaite, new mineral: Bunch, T. E. 08485
Wikieup
Chondrite, Arizona, polymict brecciated bronzite: Lewis, Charles F. 08588
Mexico
Absolute age
C-14, general listing, Univ. Michigan laboratory: Crane, H. R. 01381
C-14, general listing, Univ. Texas laboratory: Valastro, S., Jr. 01340
Areal geology
Continental platform, petroleum source rocks: Toledo Toledo, M. 08620
San Luis Potosí, Huizache-Vallejo area: Velasco Arellano, Abraham. 08648
Southern: Gutiérrez Gil, R. 08633
Valles-San Luis Potosí platform: Carrillo Bravo, J. 08641
Economic geology
Petroleum, Chihuahua, exploration, general: Navarro Galindo, A. 08639
Petroleum, Cuenca de Burgos, exploration: Yzaguirre S., L. A. 08681
Petroleum, Cuenca de Chicontepec, exploration: delaFuente Mejía, I. 08622
Petroleum, Cuenca de Tlaxiaco, possibilities: López Ticha, D. 08643
Petroleum, Cuenca de Veracruz, exploration: Reyes Domínquez, E. 08631
Petroleum, Cuenca de Veracruz, Mesozoic possibilities: Verlarde Núñez, P. 08678
Petroleum, Cuenca de Veracruz, Oligocene, Miocene possibilities: Verdugo V., R. 08632
Petroleum, Encrucijada-Chontalpa area, exploration: González Alvarado, J. 08635
Petroleum, exploration, possibilities: Viniegra O., F. 08638
Mexico – Continued
Economic geology – Continued
Petroleum, Golfo de Sabinas structure, possibilities: Salinas E., S. 08640
Petroleum, Jurassic, Upper: González, R. 08625
Petroleum, Veracruz, Cuenca de Chicontepec, source rocks, fractures: Gardía Tijerina, N. 08627
Petroleum, Veracruz, Poza Rica district, Huehuetepec field, source rocks: Ordelas, F. 08626
Petroleum, Veracruz, Poza Rica district, source rocks: Mejía Dautt, O. 08624
Geochemistry
Tabasco, Comalco area, well rock samples, X-ray fluorescence: Limón Gutiérrez, L. 08685
Geophysical surveys
Continental margin, Baja California, seismic profiles, interpretation: Moore, David G. 08669
Cuenca de Burgos, seismic: Chavira, F. C. 08619
Cuenca de Veracruz, seismic, interpretation: Acosta Ojinaga, R. 08683
Veracruz, Ahuatepec-Aragon area, seismic, velocity measurements: Oñate Espinosa, R. 08623
Veracruz, Poza Rica district, basement relief: Bello Orta, G. 08630
Yucatán, petroleum exploration, seismic, gravity: Oñate Espinosa, R. 08680
Yucatán, platform, western, gravity, application: Morales Reyna, M. 08637
Maps, geologic
San Luis Potosí, Huizache-Vallejo area: Velasco Arellano, Abraham. 08648
Mineralogy
Apatite, fluorine geochemistry, Durango: Simpson, Dale R. 08499
Paleontology
Foraminfera, Oligocene, upper, Tamaulipas: Riva Palacio, E. 08684
Sedimentary petrology
Cuenca de Burgos, Oligocene, lower: Sandoval C., M. J. 08618
Cuenca de Burgos, Oligocene sediments: Rodríquez Santana, E. 08617
Hidalgo, El Doctor Fm., lithoclastic breccia: Carrasco V., B. 08615
Stratigraphy
Cretaceous, Córdoba-Orizaba area, microfacies: Bonet Marco, F. 08682
Cretaceous, Lower, Middle, Hidalgo, Metztitlán area: Carrasco Veláquez, B. 08642
Cretaceous, Tamabra Fm., Veracruz, Poza Rica district, biostratigraphy: Becerra Hernádez, A. 08628
Mesozoic, Chiapas: Sanchez Montes de Oca. R. 08636
Paleozoic, northern, microfacies: Téllez, C. 08679
Tabasco, Comalcalco area: López Gómez, O. 08634
Tertiary, continental platform, Gulf of Mexico, biostratigraphy: Gómez Ponce, M. 08629
Michigan
Economic geology
Petroleum, exploration, Michigan basin: Burgess, R. J. 01288
Potash, Michigan basin, genesis: Matthews, R. David. 01082
General
Michigan University, open-scheduled laboratory teaching: Smith, Charles I. 01104

Michigan—Continued
Geomorphology
Au Sable, Saginaw drainage basins, hierarchical anomaly: Szucs, F. K. 01106
Lake Michigan, southeastern shore, beach dynamics: Davis, Richard A., Jr. 01068
Geophysical surveys
Kalamazoo County, bedrock topography, gravity: Ibrahim, Abdelwahid. 01076
Glacial geology
Lake Michigan lobe, Valders drift border, revision: Farrand, William R. 01187
Maps, geologic
Marenisco-Watersmeet area: Fritts, Crawford E. 08710
Paleontology
Graptolithina, Ordovician, Rapid City area, Eden age: Berry, William B. N. 01213
Sedimentary petrology
Michigan basin, Paleozoic sedimentary environments, structural controls: Prouty, C. E. 01098
Southern peninsula, glacial drift, lithofacies: Wingard, Norman E. 01113
Stratigraphy
Precambrian, Marenisco-Watersmeet area: Fritts, Crawford E. 08710
Silurian, Michigan basin: Burgess, R. J. 01288
Structural geology
Michigan Basin, tectonic pattern, Cambrian deposition, influence: Fisher, James H. 01072
Micropaleontology
Cretaceous
Maestrichtian provinces, nannofossil restriction: Worsley, T. 01365
Instruments
Electron and scanning electron microscopes, application: Charm, Walter B. 01134
Methods
Radiography, black shale: Peters, Walter G. 01096
Quaternary
New York, continental shelf, Pleistocene ecology: Gevirtz, Joel L. 01233
Mineral data
Albite
Synthesis, hydrothermal, chemical environment importance: Martin, Robert F. 08659
Apatite
Geochemistry, fluoride partitioning between solution and mineral: Simpson, Dale R. 08499
Bindheimite
Bismuthian, Utah, Eureka: Montoya, J. 08500
Biotite
Iron-bearing, equilibria with alkali feldspar: Rutherford, Malcolm J. 08565
Brezinaite
Tucson meteorite, new mineral: Bunch, T. E. 08485
Calcite
Geochemistry, topochemical reactions: Baer, Norbert Sebastian. 01223
Chlorite
Polytypism, South Carolina, Piedmont: Manley, F. H. 01333
Cordierite
Allende meteorite, first occurrence: Fuchs, Louis H. 08496
Distortion index, measurement technique: Zeck, Hubert P. 08501
Mineral data—Continued
Epsomite
Kansas, efflorescences in underground storage area, Atchison area: Tien, Pei-lin. 01202
Feldspar
Alkali, equilibria with iron biotite: Rutherford, Malcolm J. 08565
Geochemistry, New York, pegmatite: Schwarzer, Theresa Frances. 01243
Garnet
Zoned in greenschist facies, genesis: Brown, Edwin H. 08498
Heavy minerals
General description, Oregon, Sixes River, sand-size material in gravel bars: Boggs, Sam, Jr. 08650
Hexahydrite
Kansas, efflorescences in underground storage area, Atchison area: Tien, Pei-lin. 01202
Idocrase
Structure, space groups: Arem, Joel E. 08488
Magadiite
Structure, unit cell, in air and vacuo: Brindley, G. W. 08491
Magnesium silicate
Dissolution: Luce, Robert William. 01237
Magnetite
Titaniferous, coexisting ilmenite, Mn fractionation: Dasgupta, H. C. 01183
Melanite
Ti-rich, zoned, electron-probe analysis: Gomes, Celso de Barros. 08497
Metamorphic minerals
Properties, California, Franciscan rocks, blueschist facies: Seki, Y. 08714
Microcline
Structure, refinement: Bailey, S. W. 08487
Molybdenite
Hexagonal, rhombohedral, composition, differences: Clark, A. H. 01287
Palygorskite
Infrared absorption spectra: Hayashi, Hisato. 08493
Phillipsite
Synthetic, X-ray data: Kühl, G. H. 08492
Quartz
Plastic flow, high temperature, slip systems: Baëta, R. D. 08489
Plastic flow, high temperature, slip systems: Baëta, R. D. 08490
Ransomite
Structure, classification: Wood, Michael Manning. 01276
Roemerite
Structure, classification: Wood, Michael Manning. 01276
Sepiolite
Infrared absorption spectra: Hayashi, Hisato. 08493
Silicate minerals
Structure, Si-O bond length: Brown, G. E. 08486
Zeolites
Phillipsite, synthetic, X-ray data: Kühl, G. H. 08492
Mineral deposits, genesis
Phosphate
General: Sheldon, Richard P. 08836
Potash
Michigan, Michigan basin: Matthews, R. David. 01082

Mineral deposits, genesis—Continued
Structural controls
Lead, Missouri, Bonne Terre district, Roselle lineament: Gillerman, Elliot. 01169
Mineral economics
Construction materials
Maryland, Harford County, preempted land use: Edwards, Jonathan, Jr. 08828
Property evaluation
Automatic data processing: Harris, D. P. 08508
Automatic data processing, symposium: Weiss, Alfred. 08503
Grade estimation, stratiform deposits, automatic data processing: David, Michel. 08507
Mineral exploration
General
Industry decisions, role of geology: Cameron, Francis. 08807
Geologic methods
Genetic technique: Williams, Eugene G. 08667
Geophysical methods
Interpretation, soft iron ore: Seguin, Maurice K. 01317
Techniques
Automatic data processing, computer graphics, application: Kaas, L. Michael. 08504
Automatic data processing, symposium: Weiss, Alfred. 08503
Computer representation of geologic information: Dixon, Colin J. 08509
Grade estimation, stratiform deposits, automatic data processing: David, Michel. 08507
Information flow, computer-oriented: Demeter, E. J. 08516
Mineral resources
Exploration
Space technology, NASA program: Badgley, Peter C. 08690
Potential
Appraisal, automatic data processing: Harris, D. P. 08508
Mineral zoning
Pegmatite
Poikilitic albites in microcline, genesis: Fisher, D. Jerome. 08595
Mineralogy
Methods
Clay mineral separation, electromagnetic, cell types: Berry, Richard. 08703
Mining geology
Acid drainage
Neutralization, limestone use: Deul, Maurice. 08808
Technology
Anisotropic rocks, stress-relief method, borehole strain gauges: Barla, G. 01292
Automatic data processing, computer graphics, application: Kaas, L. Michael. 08504
Automatic data processing, GIPSY system, uses: Sweeney, James W. 08510
Automatic data processing, symposium: Weiss, Alfred. 08503
Minnesota
Geochemistry
Knife Lake area, Precambrian rocks, Th:U ratios: Rogers, J. J. W. 01171
Petrology
Cook County, Duluth complex, differentiation: Nathan, Harold Decantillon. 01240
Sedimentary petrology
Eastern, Franconia Fm., mineral composition: Odom, I. Edgar. 01094
Mississippi
Economic geology
Petroleum, Wilcox Fm. exploration, problems: Culbertson, Verne L. 08436
Engineering geology
Rock mechanics, delta sediments, shear strength, surface cf. cored: Bryant, William. 08456
Paleontology
Bryozoa-Anthozoa, Eocene, intergrowths: Greeley, Ronald. 01218
Mammalia, Eocene, collecting expedition: Applegate, Shelton P. 01274
Vertebrata, list, bibliography, index: Domning, Daryl P. 08464
Stratigraphy
Eocene, Zilpha Clay, Bucksnort Hill, Attala County, type locality: Welby, Charles W. 08603
Mississippian
Illinois
Salem, Saint Louis Limestones, sedimentation: Lineback, Jerry A. 01081
Kentucky
Western, Chester Series: Calvert, Ronald Harold. 01229
Missouri
Southwestern, Kinderhook-Osage Series, conodonts: Thompson, Thomas L. 01361
United States
Illinois basin, Chester Series, biotic diversity: Horowitz, Alan Stanley. 01075
Southwestern, Blastoidea, Crinoidea, n. spp., index value: Webster, G. D. 01214
Western, conodonts, Chester, phylogeny: Dunn, D. L. 01217
Missouri
Absolute age
Holts Summit and Bushberg Fms., conodonts, electron spin resonance: Morency, Maurice. 01204
Geomorphology
Southeastern, Roselle lineament: Gillerman, Elliot. 01169
Geophysical surveys
Southeastern, Roselle lineament, radar: Gillerman, Elliot. 01169
Paleontology
Conodonts, Mississippian, Kinderhook-Osage Series: Thompson, Thomas L. 01361
Stratigraphy
Mississippian, Kinderhook-Osage Series, southwestern, conodont zones: Thompson, Thomas L. 01361
Structural geology
Southeastern, Roselle fault and lineament: Gillerman, Elliot. 01169
Molluscs
Cricoconarida
Devonian, Lower, Alaska, east-central, n. spp., zonation: Churkin, Michael, Jr. 08845
Quaternary
Kansas, Sandahl fauna, Illinoian, Smoky Hill River valley: Miller, Barry B. 01372
Semicyclus brabbi, n. gen., n. sp.
Devonian, Alaska, east-central, McCann Hill Chert: Churkin, Michael, Jr. 08845
Tertiary
Gulf Coastal Plain, Paleocene-Eocene guide fossils: Toulmin, Lyman D. 08469

Molybdenum
Geochemistry
Thermal spring waters, Wyoming, Yellowstone Natl. Park: Araki, Tadashi. 08839
Oregon
Blue Mountains, Klamath Mts., occurrence, potential: King, R. U. 08736
Montana
Geophysical surveys
Boulder and Tobacco Root batholiths, gravity: Burfeind, Walter J. 08572
Princeton University gravity program, since 1965: Bonini, William E. 08600
Western, central, regional gravity, 1963: Smith, Robert B. 08571
Maps, geologic
Holter Lake quadrangle, upper: Robinson, G. D. 08677
Paleontology
Conodonts, Pennsylvanian, central, animal morphology: Melton, William. 01085
Petrology
Beartooth Mountains, Hellroaring Lakes area, Precambrian metamorphics: Rowan, Lawrence C. 01180
Sedimentary petrology
Silurian dolomites, permeability anisotropy: Roehl, Perry O. 08452
Stratigraphy
Holter Lake quadrangle, upper, sections: Robinson, G. D. 08677
Nebraska
Stratigraphy
Cambrian, subsurface: Carlson, Marvin P. 01059
Nevada
Areal geology
Nye County, Grant Range, central: Hyde, Jack H. 01130
Earthquakes
Aftershocks, microearthquakes: Ryall, Alan. 08782
Economic geology
Lithium, Clayton Valley, brines: O'Neill, Bernard J. 08663
Geomorphology
Truckee River valley, modern terrace development: Born, Stephen M. 01252
Hydrogeology
Nevada Test Site, water levels, deep aquifers, measurement: Winograd, Isaac J. 01156
Maps, geologic
Grant Range, south-central: Hyde, Jack H. 01130
Paleontology
Blastoidea, Crinoidea, Carboniferous, n. spp., index value: Webster, G. D. 01214
Brachiopoda, Devonian, early Middle, central: Johnson, J. G. 01211
Brachiopoda, Silurian, Tor Limestone, central, age: Johnson, J. G. 01212
Gymnosperms, Pleistocene, late, Christmas Tree Pass area, changes: Leskinen, Paul. 08585
Petrology
Humboldt County, Buffalo Mtn. pluton: Neff, Thomas Rodney. 01275
Stratigraphy
Silurian, Tor Limestone, central, not Devonian: Johnson, J. G. 01212
Nevada—Continued
Structural geology
Humboldt County, Buffalo Mtn. pluton, emplacement: Neff, Thomas Rodney. 01275
New Hampshire
Geochemistry
Ossipee Lake quadrangle, geochemical prospecting: Cox, Dennis P. 08800
Maps, geochemical
Ossipee Lake quadrangle, heavy metals, citrate-soluble: Cox, Dennis P. 08800
New Jersey
Stratigraphy
Eocene, Coastal plain, biostratigraphy: Enright, Richard Louis Charles, Jr. 01231
New Mexico
Economic geology
Coal, Casa Grande quadrangle, occurrence: Pillmore, Charles L. 08675
Maps, geologic
Casa Grande quadrangle: Pillmore, Charles L. 08675
Jemez Mountains: Smith, R. L. 01208
Stratigraphy
Cretaceous-Quaternary, Casa Grande quadrangle, section: Pillmore, Charles L. 08675
Jemez Mountains, section: Smith, R. L. 01208
Precambrian, Kiawa Mtn. Fm., members, Tusas Mts., nomenclature: Barker, Fred. 01307
Weathering
High plains, caliche soil genesis, analyses: Aristarain, L. F. 01123
New York
Geochemistry
Adirondack Mountains, anorthosite-charnockite, major elements: Crosby, Percy. 01066
Pegmatite, feldspar pairs, element distribution: Schwarzer, Theresa Frances. 01243
Geomorphology
Northwestern, glacial lake, strandlines: Calkin, Parker E. 01384
Glacial geology
Little Falls-Richfield Springs area: Whipple, Janice M. 01245
Northwestern, glacial lake chronology: Calkin, Parker E. 01384
Hydrogeology
Suffolk County, southwestern, ground-water contamination: Perlmutter, N. M. 01263
Maps, geomorphologic
Northwestern, glacial features: Calkin, Parker E. 01384
Paleontology
Bryozoa, Ordovician, Mohawkian, descriptions, correlation: Ross, June Phillips. 01280
Bryozoa, Silurian, Niagara region, cf. England, Sweden: Owen, David E. 08671
Sedimentary petrology
Long Island, shelf, sediments: McKinney, Thomas Francis. 01239
Stratigraphy
Devonian, Hamilton Group: Cooper, Gustav Arthur. 01230
Devonian, western, Portage Group, name abandoned: deWitt, Wallace, Jr. 01308
Structural geology
Southeastern, gravity sliding, Taconic region: Bird, John M. 08843

Newfoundland
Absolute age
C-14, general listing, Trondheim laboratory: Nydal, Reider. 01337
Maps, geologic index
Sheet 23: Canada Geological Survey. 01264
Maps, magnetic
Belleoram area, airborne: Canada Geological Survey. 00996
Burgeo area, airborne: Canada Geological Survey. 00991
Codroy area, airborne: Canada Geological Survey. 00982
Dildo area, airborne: Canada Geological Survey. 00999
Facheux Bay area, airborne: Canada Geological Survey. 00994
Gaultois area, airborne: Canada Geological Survey. 00995
Grandys Lake area, airborne: Canada Geological Survey. 00983
Harbour Buffet area, airborne: Canada Geological Survey. 00998
Harbour Grace area, airborne: Canada Geological Survey. 01000
Heart's Content area, airborne: Canada Geological Survey. 00986
La Hune area, airborne: Canada Geological Survey. 00993
La Poile area, airborne: Canada Geological Survey. 00990
Port aux Basques area, airborne: Canada Geological Survey. 00988
Pouch Cove area, airborne: Canada Geological Survey. 00987
Ramea area, airborne: Canada Geological Survey. 00992
Rose Blanche area, airborne: Canada Geological Survey. 00989
Saint John's area, airborne: Canada Geological Survey. 01001
Sound Island area, airborne: Canada Geological Survey. 00984
Sunnyside area, airborne: Canada Geological Survey. 00985
Terrenceville area, airborne: Canada Geological Survey. 00997
Structural geology
Appalachians, folds, slump vs. tectonic: Helwig, James. 01121
Nickel
Oregon
Southwestern, resources, production: Hotz, P. E. 08737
North America
Economic geology
Petroleum, continental shelf, exploration, political environment: Massad, A. H. 08432
Uranium, western, occurrence, reserves: Robertson, David S. 08805
Geophysical surveys
Western, coastal and offshore, gravity, Oregon State Univ. program: Couch, R. W. 08578
Western, gravity calibration line, pendulum measurements: Valliant, H. D. 08568
Western, gravity, symposium: Barnes, David F. 08567
Paleontology
Conodonts, Ordovician, northeastern, ultrastructure: Barnes, Christopher R. 01050
North America—Continued
Paleontology—Continued
Echinodermata, Ordovician, Middle, primitive: Parsley, Ronald Lee. 01117
Foraminifera, evolution, *Buliminella* groups, n. sp., subsp.: Seiglie, George A. 08819
North Carolina
Economic geology
Lithium, Kings Mountain area, pegmatite, spodumene-bearing: O'Neill, Bernard J. 08663
Geomorphology
Barrier islands, washover fans, inlets, storm surge genesis: Pierce, J. W. 01125
Continental slope off Cape Hatteras, submarine canyons: Rona, Peter A. 01120
Paleontology
Tracks and trails, Holocene, beaches, anthozoan burrows: Frey, R. W. 01279
North Dakota
Absolute age
Southeastern, Quaternary lacustrine deposit, C-14: Bickley, William B., Jr. 01055
Geomorphology
North-central, Lake Souris, landforms: Moran, Stephen R. 01091
Southwestern, tundra polygons: Clayton, Lee. 01062
Stratigraphy
Quaternary, lacustrine beds, new, paleoecology: Bickley, William B., Jr. 01055
Northwest Territories
Absolute age
Baffin Island, glacial deposits: Andrews, J. T. 01251
Geomorphology
Baffin Island, Foxe Basin area, shore features: King, C. A. M. 08614
Geophysical surveys
Ellesmere Island, radio-echo sounding, glaciers: Hattersley-Smith, G. 08701
Yellowknife seismic array, calibration, explosion experiment: Weichert, D. H. 08613
Glacial geology
Baffin Island, chronology, glacial rebound: Andrews, J. T. 01251
Maps, geologic index
Franklin, sheets 48, 58 and 59, 69, 79: Canada Geological Survey. 01366
Franklin-Mackenzie-Keewatin, sheet 67, 77: Canada Geological Survey. 01265
Maps, magnetic
Franklin, Sheet 37 C:16, airborne: Canada Geological Survey. 01015
Franklin, Sheet 37 F:1, airborne: Canada Geological Survey. 01016
Franklin, Sheet 37 F:8, airborne: Canada Geological Survey. 01017
Franklin, Sheet 37 F:9, airborne: Canada Geological Survey. 01018
Franklin, Sheet 37 F:16, airborne: Canada Geological Survey. 01019
Franklin, Sheet 37 G:1, airborne: Canada Geological Survey. 01020
Franklin, Sheet 37 G:8, airborne: Canada Geological Survey. 01021
Franklin, Sheet 37 G:9, airborne: Canada Geological Survey. 01022
Nuclear explosions
Applications
Plowshare, techniques, teaching, Pennsylvania State University: Saperstein, L. W. 08668

Nuclear explosions – Continued
Detection
Amplitude spectra, distinguishing from explosions: Molnar, Peter. 01298
Nuclear magnetic resonance
Methods
Porous materials, porosity, permeability, surface area: Kumar, J. 01272
Oceanography
Education
Deep Sea Drilling Project, raw data, student involvement: Vallier, Tracy L. 01109
Instruments
Remote sensing, applications, interpretation, symposium: Badgley, Peter C. 08691
Methods
Remote sensing, applications, interpretation, symposium: Badgley, Peter C. 08691
Remote-sensing, sea ice, extent, imagery interpretation: McLerran, James H. 08770
Ohio
General
Ohio State University, earth science teachers, preparation: Mayer, Victor J. 01083
Hydrogeology
Akron area, ground-water resources, development: Rau, Jon L. 01099
Paleontology
Amphibia, Permian, Creston Shale, Marietta area: Olson, Everett C. 01270
Cephalopoda, Pennsylvanian, Brush Creek Ls., nautiloids: Murphy, James L. 01210
Sedimentary petrology
Garfield Heights, Pleistocene sediments, environment: Miller, Barry B. 01088
Stratigraphy
Precambrian-Cambrian, Sauk sequence, subsurface: Janssens, A. 01078
Silurian, Bass Islands Fm., members, Bass Islands: Sparling, Dale R. 01351
Oil and gas fields
California
Clarksburg gas field: Lorshbough, A. L. 01254
Cymric field: Anderson, David N. 01164
Northwest San Joaquin gas field: Hill, F. L. 01166
Valpredo oil field: Welge, E. A. 01167
Louisiana
Southwest Lake Arthur oil field: Gotautas, Vito A. 08455
Wyoming
Hilight field: Tesone, V. P. 01314
Oil shale
Oregon
Jackson County, resources: Newton, V. C., Jr. 08756
Rocky Mountains
Green River Fm., genesis, modern analog: Bradley, W. H. 01250
Oklahoma
Mineralogy
Clay minerals, Desmoinesian rocks, diagenesis, effects: Bucke, David Perry, Jr. 01228
Paleontology
Palynology, Permian, Flowerpot Fm., paleogeography: Clapham, W. B., Jr. 01181
Palynomorphs, Permian, Flowerpot Fm., western: Clapham, W. B., Jr. 01304
Stratigraphy
Cambrian, Wichita-Arbuckle Mts., biostratigraphy: Stitt, James H. 01105
Oklahoma – Continued
Stratigraphy – Continued
Mississippian, Kinderhook-Osage Series, northeastern, conodont zones: Thompson, Thomas L. 01361
Paleozoic, Ouachita Mountains, pre-Womble Shale section: Madeley, Hulon M. 01325
Ontario
Absolute age
Gunflint Fm., Rb-Sr: Misra, A. 01185
Geomorphology
Niagara escarpment, re-entrant valleys, pre-glacial: White, Owen L. 01111
Structural geology
Sudbury area, Grenville front, mylonitic rocks, deformation: Brown, Jim McCaslin. 01057
Ordovician
Appalachians
Central, Upper lithofacies, nomenclature: Thompson, Allan M. 01147
Conodonts
Evolution, prioniodid: Bergström, Stig M. 01054
Florida
North-central, Protista: Andress, Noel E. 08463
Georgia
Northwestern, Chickamauga Supergroup, bentonite: Martin, B. F. 01326
Kentucky
Central, Drakes Fm., Bardstown Member: Peterson, Warren L. 01312
Manitoba
Northern, biostratigraphy: Norford, B. S. 01133
Michigan
Rapid City area, Graptolithina, correlation, Eden age: Berry, William B. N. 01213
New York
Bryozoa, Mohawkian, descriptions, paleoecology, correlation: Ross, June Phillips. 01280
Taconic region, tectonics, gravity sliding: Bird, John M. 08843
North America
Echinodermata, primitive, Middle: Parsley, Ronald Lee. 01117
Northeastern, conodonts: Barnes, Christopher R. 01050
Quebec
Gaspé Peninsula, Cloridorme Fm.: Enos, Paul. 08694
United States
Cambrian boundary, age discrepancies: Miller, James F. 01089
Vermont
Taconic region, tectonics, gravity sliding: Bird, John M. 08843
Virginia
Arvonia district, Trilobita, Arvonia Slate: Tillman, C. G. 01140
Oregon
Absolute age
Newberry Volcano flows, C-14 and hydration-rind dating: Peterson, N. V. 08687
Areal geology
Basin and Range province: Walker, G. W. 08725
Blue Mountains: Thayer, T. P. 08721
Cascade Range: Griggs, A. B. 08797
Coast Range and Willamette Valley: Snavely, P. D., Jr. 08717
Deschutes-Umatilla Plateau: Newcomb, R. C. 08719
Geologic history: Corcoran, R. E. 08796
High Lava Plains: Walker, G. W. 08723
Joseph Upland: Newcomb, R. C. 08720
Klamath Mountains: Ramp, Len. 08718

Oregon—Continued
Cereal geology—Continued
Langlois quadrangle, southern half: Lent, Robert Louis. 01236
Major geomorphic sections: Dole, Hollis M. 08716
Newport area, guidebook: Snavely, Parke D., Jr. 08649
Owyhee Upland: Corcoran, R. E. 08724
Snake River Canyon: Brooks, H. C. 08722
Summary: U.S. Geological Survey. 08715
Earthquakes
1969, Aug. 14, North Powder area: Couch, Richard. 08656
Economic geology
Antimony, resources, production history: Wagner, N. S. 08727
Asbestos, olivine, other Mg-silicates, occurrence, potential: Wagner, N. S. 08798
Bauxite, northwestern and Willamette Valley: Corcoran, R. E. 08728
Borates, eastern, possibilities: Wagner, N. S. 08743
Carbon dioxide, possibilities, soda-water springs: Wagner, N. S. 08799
Chromite, occurrence, resources: Thayer, T. P. 08729
Clays, northwestern and western, occurrence, resources: Mason, R. S. 08795
Coal, occurrence, resources: Mason, R. S. 08755
Cobalt, occurrence: Vhay, J. S. 08730
Construction materials, stone, occurrence, production: Mason, R. S. 08753
Copper, lead, zinc, occurrence: Bowen, R. G. 08731
Diatomite, occurrence, potential: Wagner, N. S. 08744
Feldspar, occurrence: Sheppard, R. A. 08748
Gems, occurrence: Mason, R. S. 08794
Gold, silver, Blue Mountains and western: Brooks, H. C. 08732
Gravel, occurrence: Schlicker, H. G. 08750
Gypsum, resources: Wagner, N. S. 08745
Heavy minerals, black sands, southwestern: Clifton, H. E. 08834
Heavy minerals, Sixes River, sand-size material in gravel bars: Boggs, Sam, Jr. 08650
Iron, occurrence: Mason, R. S. 08733
Manganese, resources: Appling, R. N., Jr. 08734
Mercury, occurrence, production history: Brooks, H. C. 08735
Mineral resources: U.S. Geological Survey. 08715
Mineral resources, Blue Mts.: Thayer, T. P. 08721
Mineral resources, Joseph Upland: Newcomb, R. C. 08720
Mineral resources, Owyhee Upland, potential: Corcoran, R. E. 08724
Mineral resources, production history: Weissenborn, A. E. 08726
Molybdenum, Blue Mountains, Klamath Mts.: King, R. U. 08736
Nickel, southwestern, resources: Hotz, P. E. 08737
Oil shale, Jackson County, resources: Newton, V. C., Jr. 08756
Peat, resources, production: Cameron, C. C. 08746
Petroleum, natural gas, possibilities: Wagner, H. C. 08757
Platinum, southwestern and northeastern: Ramp, Len. 08738

Oregon—Continued
Economic geology—Continued
Pumice, perlite, cinders, resources: Wagner, N. S. 08747
Salt, occurrence, saline waters: Newton, V. C., Jr. 08749
Sand, resources: Ramp, Len. 08751
Sodium carbonate, anhydrous, Lake County: Mason, R. S. 08752
Titanium, occurrence: Herz, Norman. 08739
Tungsten, resources: Hobbs, S. W. 08740
Uranium, southern and central, resources, production: Peterson, N. V. 08741
Vanadium, occurrence: Fischer, R. P. 08742
Zeolites, central and southeastern, occurrence: Sheppard, R. A. 08754
Geochemistry
Saline waters, analyses: Newton, V. C., Jr. 08749
Geomorphology
Lake Oswego area, landform evolution, sequence of events: Parsons, Roger B. 08654
Saddle Butte area, lava-tube caves: Ciesiel, Robert F. 08651
Sawtooth Ridge, volcanic crater, differential erosion: Patterson, Peter V. 08652
Geothermal energy
Klamath and Lake Counties, possibilities: Godwin, L. H. 08758
Hydrogeology
Ground and other water resources: Phillips, K. N. 08759
Ground-water resources: U.S. Geological Survey. 08715
Maps, geologic
Bend quadrangle, east half: Swanson, Donald A. 08560
Cedar Butte area: Nelson, Dennis O. 08686
General: U.S. Geological Survey. 08715
Mineralogy
Heavy minerals, Sixes River, sand-size material in gravel bars: Boggs, Sam, Jr. 08650
Sixes and Pistol Rivers area, plutons, paragenesis: Lund, Ernest H. 08655
Paleontology
Angiosperms, Cretaceous-Oligocene, palms: Gregory, Irene. 08688
Angiosperms, Eocene, Clarno Fm., poplar, worm-bored: Gregory, Irene. 08653
Pelecypoda, Jurassic, Dothan(?) Fm., age: Ramp, Len. 08657
Protista, Miocene, Bandon diatomite, silicoflagellates, cf. California: Orr, William N. 01191
Petrology
Eugene area, porphyritic intrusion, nonporphyritic selvage, origin: Lund, Ernest H. 01199
Klamath Mountains, Greyback intrusive complex, contact aureole: Godchaux, Martha Miller. 01235
Mitchell area, mudstones, alteration by Tertiary intrusions: Jarman, Clara. 01197
Northeastern, Mount Saint Helens Y ash layer, distribution: Norgren, J. A. 01200
Sixes and Pistol Rivers area, intrusions: Lund, Ernest H. 08655
Sedimentary petrology
Snake River Canyon, Triassic conglomerates, granitic clasts: Vallier, Tracy L. 01110
Stratigraphy
Cretaceous-Quaternary, Bend quadrangle, east half, sections: Swanson, Donald A. 08560

Oregon—Continued
Stratigraphy—Continued
Tertiary, Newport area: Snavely, Parke D., Jr. 08649
Tertiary, volcanics-sediments series, Cedar Butte area: Nelson, Dennis O. 08686
Volcanology
Cedar Butte area, Tertiary: Nelson, Dennis O. 08686
Newberry Volcano, Holocene flows, age: Peterson, N. V. 08687
Organic materials
Kerogen
Geochemistry, aromatic products, n-alkanes, Precambrian rocks: Scott, Ward M. 01364
Sedimentary rocks, analysis, pyrolysis, chromatography: Giraud, A. 01126
Orogeny
Appalachian
Plate tectonics role: Bird, John M. 01137
Caledonian
Cyclicity, review, worldwide: Pronin, A. A. 08822
Ostracoda
Costa spp.
Cenozoic, Caribbean region, distribution: Bold, W. A. van den. 01303
Morphology
Pores, electron microscope studies: Puri, Harbans S. 08521
Taxonomy
Use of pores in systematic studies: Puri, Harbans S. 08521
Tertiary
Puerto Rico, Ponce Fm., and Lajas Valley limestone, correlation: Bold, W. A. van den. 08820
Oxygen
Isotopes
O-18, benthic foraminifera, paleotemperature, value questioned: Duplessy, J. C. 01289
Pacific Ocean
Geochemistry
East Pacific Rise area, pillow basalt, Ar-40 excess: Dymond, Jack. 01136
East Pacific Rise, foraminifera solution, lysocline: Berger, Wolfgang H. 01348
Geophysical surveys
Aleutian trench, gravity, crustal studies: Malahoff, Alexander. 08581
Mineralogy
Clay minerals, lutites, Cascadia Basin off Oregon: Duncan, John R. 01122
Paleoclimatology
Quaternary, Cascadia Basin, Holocene faunal indicators: Griggs, G. B. 01349
Sedimentary petrology
Eastern, clay-mineral distribution: Rateev, M. A. 08692
Foraminifera, sedimentation, sea-water solution: Berger, Wolfgang H. 01348
Paleobotany
Tertiary
Arkansas, Eocene, Wilcox Fm., phylloxerid galls: Wittlake, Eugene B. 08768
British Columbia, Oregon, Eocene chert: Arnold, Chester A. 01048
Paleoclimatology
Bermuda
Pleistocene, fluctuations, effect on snail diversity: Gould, Stephen Jay. 01207
Paleoclimatology—Continued
Indicators
Foraminifera, oxygen isotopes, value questioned: Duplessy, J. C. 01289
Quaternary
Arkansas, prairie mounds, Altithermal desert alluviation: Beckman, Michael A. 08699
British Columbia, Atlin Valley, Holocene changes: Anderson, James H. 01047
California, Mojave Desert, Clark Mtn. area: Mehringer, Peter J., Jr. 08608
California, Tanner Basin: Kheradpir, Ahmad. 01302
Gulf of Mexico, northern: Elsik, William C. 08551
Gulf of Mexico, northern, planktonic foraminifers as indicators: Beard, John H. 08552
Gulf of Mexico, Pleistocene sediments, C-13:C-12 correlation: Rogers, M. A. 08478
Manitoba, southern, Holocene: Ritchie, J. C. 08766
Pacific Ocean, Cascadia Basin: Griggs, G. B. 01349
Tertiary
Gulf of Mexico, northern: Elsik, William C. 08551
Paleoecology
Analysis
Faunal, biogeochemical techniques, Plio-Pleistocene section: Dodd, J. Robert. 01069
Anthozoa
Eocene, marine, Alabama-Mississippi: Greeley, Ronald. 01218
Brachiopoda
Paleozoic, marine, lingulids: Paine, Robert T. 01378
Bryozoa
Eocene, marine, Alabama-Mississippi: Greeley, Ronald. 01218
Ordovician, marine carbonate facies, New York: Ross, June Phillips. 01280
Cephalopoda
Pennsylvanian, marine, Ohio, Brush Creek Ls.: Murphy, James L. 01210
Echinodermata
Pennsylvanian, benthonic, Illinois, Desmoinesian: Fraunfelter, G. H. 01215
Foraminifera
Pleistocene, continental shelf, New York: Gevirtz, Joel L. 01233
Quaternary, marine, California, Tanner Basin: Kheradpir, Ahmad. 01302
Gymnosperms
Quaternary, montane, California, Clark Mtn.: Mehringer, Peter J., Jr. 08608
Indicators
Gastropoda, shells in archeological sites: Clark, John W., Jr. 08696
Methods
Statistical, cluster analysis, measurement of distortion: Kaesler, Roger L. 01146
Phanerozoic
Benthonic, shelf fauna, taxa, ecosystems: Valentine, James W. 08670
Quaternary
Lacustrine, North Dakota, southeastern: Bickley, William B., Jr. 01055
Lacustrine, Ohio, Fairlawn mastodon site: Teeter, James W. 01108
Terrestrial, Arkansas, Peccary Cave: Davis, Leo Carson. 08698

Paleoecology—Continued
Tertiary
Lacustrine, Arkansas, Wilcox Fm., phylloxerid plant galls: Wittlake, Eugene B. 08768
Marine, New Jersey, Eocene: Enright, Richard Louis Charles, Jr. 01231
Paleogeography
Cambrian
United States, midcontinent, Upper, basement relief: Meyerhoff, Howard A. 01087
Cenozoic
Washington, Camas area, Prune Hill: Aviolo, Gennara. 01195
Pennsylvanian-Permian
Texas, north-central, Cisco Group paleoslope: Brown, L. F., Jr. 08434
Permian
Oklahoma, middle: Clapham, W. B., Jr. 01181
Silurian
New York, Niagara region cf. England, Sweden: Owen, David E. 08671
Paleomagnetism
Applications
Marine sedimentary cores, evaluation: Watkins, N. D. 08483
Geochronology
Deep-sea cores, preliminary studies: Opdyke, N. D. 08544
Reversals
Dating techniques, deep-sea cores, preliminary studies: Opdyke, N. D. 08544
Paleontology
Collecting
Eocene whales, Mississippi: Applegate, Shelton P. 01274
Education
Traditional courses, integration with paleoecology: Laporte, Leo F. 01079
Extinctions
Conodonts, evolutionary, ecologic, geographic observations: Mosher, L. Cameron. 01092
Paleozoic
Arkansas
Ouachita Mountains, pre-Womble Shale section: Madeley, Hulon M. 01325
Brachiopoda
Paleoecology, lingulids, sediment preference: Paine, Robert T. 01378
Bryozoa
Biometric procedures in taxonomy: Anstey, Robert L. 01219
Colorado
Front Range, pre-Pennsylvanian, conodonts, stratigraphy: Goebel, Edwin D. 01073
Conodonts
Geographic distribution: Collinson, Charles. 01063
Lower, provinces: Barnes, Christopher R. 01049
Upper, geographic distribution: Druce, Edric. 01071
Maryland
Harford County, Cambrian?-Ordovician, units: Southwick, David L. 08837
Mexico
Northern, microfacies: Téllez, C. 08679
Michigan
Michigan basin, Lower, sedimentation: Prouty, C. E. 01098
Nevada
Grant Range, central, stratigraphy, history: Hyde, Jack H. 01130
Paleozoic—Continued
Oklahoma
Ouachita Mountains, pre-Womble Shale section: Madeley, Hulon M. 01325
Palynology
Devonian
United States, midcontinent, eastern: Norton, Norman J. 01093
Permian
Oklahoma, middle, flora: Clapham, W. B., Jr. 01181
Quaternary
British Columbia, Atlin Valley, Holocene: Anderson, James H. 01047
Georgia, Okefenokee Swamp, Charlton County: Bond, T. A. 01380
Manitoba, lake sediment, Holocene, frequencies, environment: Ritchie, J. C. 08766
West Virginia, Morgantown area: Parsons, Barbara Mae. 01222
Yukon, Snag-Klutlan area, Pleistocene: Rampton, Vernon Neil. 01242
Tertiary
Gulf of Mexico, northern, Neogene: Elsik, William C. 08551
Palynomorphs
Gnetalesaccus, n. gen.
Permian, Oklahoma, Flowerpot Fm.: Clapham, W. B., Jr. 01304
Oklahomaspora, n. gen.
Permian, Oklahoma, Flowerpot Fm.: Clapham, W. B., Jr. 01304
Paludospora, n. gen.
Permian, Oklahoma, Flowerpot Fm.: Clapham, W. B., Jr. 01304
Permian
Oklahoma, Flowerpot Fm., western, n. gen., n. spp.: Clapham, W. B., Jr. 01304
Polylophothylax, n. gen.
Permian, Oklahoma, Flowerpot Fm.: Clapham, W. B., Jr. 01304
Tertiary
Gulf of Mexico, northern, Neogene, descriptions: Elsik, William C. 08551
Paragenesis
Orthophosphate-orthoarsenate family
M:O ratios trend: Moore, Paul B. 01286
Plutonic rocks
Oregon, Sixes and Pistol Rivers area, intrusions: Lund, Ernest H. 08655
Patterned ground
Tundra polygons
North Dakota, southwestern: Clayton, Lee. 01062
Peat
Oregon
Resources, production: Cameron, C. C. 08746
Pebbles
Idaho
Triassic conglomerates, granitic clasts: Vallier, Tracy L. 01110
Oregon
Triassic conglomerates, granitic clasts: Vallier, Tracy L. 01110
Pelecypoda
Buchia piochii
Jurassic, Oregon, Dothan(?) Fm., age: Ramp, Len. 08657
Lucinidae
Classifications, phenetic and phylogenetic: Bretsky, Sara Stewart. 01248

Pelecypoda – Continued
Quaternary
Marine faunas, Holocene, deposit feeders: Nicol, David. 08465
Taxonomy
Phenetic cf. phylogenetic approach: Bretsky, Sara Stewart. 01248
Pennsylvania
Economic geology
Clays, western, exploration, genetic method: Williams, Eugene G. 08667
Mineral resources, Carmichaels quadrangle: Kent, Bion H. 08563
Mineral resources, Mather quadrangle: Kent, Bion H. 08790
General
Pennsylvania State University, remote sensing training: Lattman, Laurence H. 01186
State University, College of Earth and Mineral Sci., Mineral Constitution Labs.: Bell, Maurice E. 08693
State University, mining engineering education, nuclear explosives: Saperstein, L. W. 08668
Geochemistry
Nittany Valley, ground and surface waters: Langmuir, Donald. 08664
Hydrogeology
Nittany Valley, ground and surface waters, quality: Langmuir, Donald. 08664
Maps, geologic
Carmichaels quadrangle: Kent, Bion H. 08563
Mather quadrangle: Kent, Bion H. 08790
Paleontology
Cephalopoda, Pennsylvanian, Brush Creek Ls., nautiloids: Murphy, James L. 01210
Sedimentary petrology
Erie, Jefferson Counties, soils: Kohland, William Francis. 01221
Stratigraphy
Pennsylvanian-Permian, Quaternary, Carmichaels quadrangle, section: Kent, Bion H. 08563
Pennsylvanian-Permian, Quaternary, Mather quadrangle, section: Kent, Bion H. 08790
Permian, Waynesburg Fm., sandstone lentil: Martin, W. D. 01367
Permian, Waynesburg Fm., sandstone lentils, distribution: Roen, John B. 01131
Structural geology
Hazelton area, fault: Faill, Rodger T. 01255
Pennsylvanian
Arkansas
Northern, Morrow Group, Cephalopoda, biostratigraphy: Quinn, James Harrison. 08697
Conodonts
Faunal variations, non-biostratigraphic controls: Merrill, Glen K. 01086
Illinois
Echinodermata, edrioasteroids, n. sp., Desmoinesian: Fraunfelter, G. H. 01215
Kentucky
Eastern, Breathitt Fm., Magoffin Beds, sedimentation: Outerbridge, W. F. 01174
Montana
Central, conodonts, animal morphology: Melton, William. 01085
Ohio
Eastern, Cephalopoda, Brush Creek Ls.: Murphy, James L. 01210
Pennsylvania
Western, Cephalopoda, Brush Creek Ls.: Murphy, James L. 01210
Pennsylvanian – Continued
Texas
North-central, Cisco Group, distribution, paleogeography: Brown, L. F., Jr. 08434
Western, Cephalopoda, Magdalena Fm., arctic ammonoid: Nassichuk, W. W. 01220
United States
Southwestern, Crinoidea, n. spp., index value: Webster, G. D. 01214
Western, conodonts, Morrow, phylogeny: Dunn, D. L. 01217
Permafrost
Alaska
Barrow area, ionic concentration gradients: Brown, Jerry. 08823
Washington
Southeastern, Pleistocene, Touchet Beds, clastic dikes: Alwin, John A. 01193
Permian
Ohio
Marietta area, Creston Shale, Amphibia: Olson, Everett C. 01270
Oklahoma
Palynology, paleogeography, middle: Clapham, W. B., Jr. 01181
Western, Flowerpot Fm., palynomorphs: Clapham, W. B., Jr. 01304
Pennsylvania
Southwestern, Waynesburg Fm., sandstone lentil distribution: Martin, W. D. 01367
Southwestern, Waynesburg Fm., sandstone lentil distribution: Roen, John B. 01131
Texas
North-central, Cisco Group, distribution, paleogeography: Brown, L. F., Jr. 08434
Petrofabrics
Methods
Orientation data analysis, use of computer: LaFountain, Lester J. 01144
Petroleum
Alberta
Keg River pinnacle reefs, new discovery: Robertson, J. W. 08840
California
Cymric field, occurrence: Anderson, David N. 01164
Elk Hills field, exploration, gravity: Corbató, Charles E. 08577
Valpredo field, Santa Margarita sandstone: Welge, E. A. 01167
Exploration
Automatic data processing, program for sample normality tests: Preston, D. A. 01118
Fossil reefs, continental shelf development, possibilities: Levert, Charles F., Jr. 08437
Methods, unconventional, symposium: Heroy, William B. 08764
Genesis
Accumulation, effect of ground water, relation to exploration: Rogers, James K. 08440
Gulf Coastal Plain
Exploration, photogeology, application: Haye, Edward F. 08450
Gulf of Mexico
Southwestern, genesis in deep-sea sediments, upward movement: Rezak, Richard. 08439
Western Gulf basin, possible future provinces: Mason, B. B. 08448
Indiana
Production, development, 1968: Carpenter, G. L. 08707

Petroleum—Continued
Kentucky
Central City West quadrangle, occurrence: Palmer, James E. 08832
Louisiana
Bay Marchand-Timbalier Bay-Caillou Island salt complex, production: Frey, M. G. 08454
Southwest Lake Arthur field, geology-geophysics, integration: Gotautas, Vito A. 08455
Mexico
Chihuahua, exploration, general: Navarro Galindo, A. 08639
Continental platform, exploration, source rocks: Toledo Toledo, M. 08620
Cuenca de Burgos, exploration: Yzaguirre S., L. A. 08681
Cuenca de Chicontepec, exploration: delaFuente Mejía, I. 08622
Cuenca de Tlaxiaco, possibilities: López Ticha, D. 08643
Cuenca de Veracruz, exploration: Reyes Domínquez, E. 08631
Cuenca de Veracruz, Mesozoic possibilities: Verlarde Núñez, P. 08678
Cuenca de Veracruz, Oligocene, Miocene possibilities: Verdugo V., R. 08632
Encrucijada-Chontalpa area, exploration: González Alvarado, J. 08635
Exploration, Jurassic, Upper: González, R. 08625
Exploration, possibilities: Viniegra O., F. 08638
Golfo de Sabinas structure, possibilities: Salinas E., S. 08640
Veracruz, Cuenca de Chicontepec, source rocks, fractures: García Tijerina, N. 08627
Veracruz, Poza Rica district, exploration, source rocks: Mejía Dautt, O. 08624
Veracruz, Poza Rica district, Huehuetepec field, possibilities: Ordelas, F. 08626
Michigan
Michigan basin, possibilities: Burgess, R. J. 01288
Mississippi
Southwestern, Wilcox Fm., exploration, problems: Culbertson, Verne L. 08436
North America
Continental shelf, exploration, political environment: Mussad, A. H. 08432
Oregon
Possibilities: Wagner, H. C. 08757
Texas
Southern, Frio formation, exploration, depositional history importance: Martin, Gene B. 08470
Wyoming
Powder River basin, Hilight field: Tesone, V. P. 01314
Petrology
Methods
Rock classification, CORFAN-FORTRAN IV computer program: Ondrick, C. W. 01362
Phanerozoic
Benthonic fauna
Taxonomic, ecologic patterns: Valentine, James W. 08670
Phase equilibria
General
Diagrams for ceramists, oxide, salt, and sulfide systems: Levin, Ernest M. 08704
Phase equilibria—Continued
K-Al-Na-Si-Fe-O-H
Iron biotite-alkali feldspar, experimental: Rutherford, Malcolm J. 08565
Phosphate
Resources
Worldwide: Sheldon, Richard P. 08836
Photogeology
Applications
Surface faulting, use in regional seismicity studies: Slemmons, David B. 08781
Gulf Coastal Plain
Interpretation, application to petroleum exploration: Haye, Edward F. 08450
Photography
Infrared, aerial, sedimentary processes: Levy, John S. 01172
United States
Midcontinent, bison trails, distinguished from joint traces: Clayton, Lee. 01061
Platinum
Oregon
Southwestern and northeastern, resources, potential: Ramp, Len. 08738
Potash
Michigan
Michigan basin, genesis: Matthews, R. David. 01082
Precambrian
Life, origin
Kerogen content of rocks: Scott, Ward M. 01364
Maryland
Harford County, Baltimore Gneiss and younger metamorphics: Southwick, David L. 08837
Michigan
Marenisco-Watersmeet area, stratigraphy: Fritts, Crawford E. 08710
Montana
Beartooth Mountains, Hellroaring Lakes area: Rowan, Lawrence C. 01180
New Mexico
Tusas Mountains, Kiawa Mtn. Fm., members, nomenclature: Barker, Fred. 01307
Ohio
Subsurface, Sauk sequence: Janssens, A. 01078
South Dakota
Galena-Roubaix district, stratigraphy: Bayley, R. W. 01374
Protactinium
Geochemistry
Caribbean Sea, Cariaco Trench, sediment cores: Rona, Elizabeth. 08527
Protista
Chitinozoa
Ordovician, Florida, north-central, taxonomy: Andress, Noel E. 08463
Silurian, Florida, well samples: Goldstein, Robert F. 08525
Coccolithophores
Cretaceous-Pleistocene, Atlantic Ocean, deep-sea cores: Bukry, David. 01355
Jurassic-Pleistocene, deep-sea sediments, age: Hay, W. W. 08538
Jurassic-Tertiary, Atlantic Ocean, deep-sea cores, biostratigraphy: Bukry, David. 08548
Pliocene-Pleistocene, Gulf of Mexico, deep-sea cores, biostratigraphy: Bukry, David. 08548
Nannofossils
Cretaceous, Maestrichtian provinces, restriction: Worsley, T. 01365

Protista—Continued
Silicoflagellates
Miocene, Oregon, Bandon diatomite, cf. California, Buttle diatomite: Orr, William N. 01191
Pteridophytes
Devonian
Alaska, graptolitic shale, Noyes Island: Churkin, Michael, Jr. 08672
Drepanophycus sp.
Devonian, Alaska, Noyes Island, graptolitic shale: Churkin, Michael, Jr. 08672
Hostimella spp.
Devonian, Alaska, Noyes Island, graptolitic shale: Churkin, Michael, Jr. 08672
Puerto Rico
Paleontology
Ostracoda, Neogene, Ponce Fm. and Lajas Valley limestone: Bold, W. A. van den. 08820
Structural geology
Tectonics, Cretaceous-Eocene, sedimentation evidence: Almy, Charles C., Jr. 08457
Pumice
Oregon
Resources: Wagner, N. S. 08747
Quaternary
Arizona
Christmas Tree Pass area, Pleistocene vegetation, late, changes: Leskinen, Paul. 08585
San Pedro Valley, Mammalia, Pliocene-Pleistocene, Benson beds: Hemmings, E. Thomas. 08606
White Mountains, Pleistocene glaciations, features: Merrill, Robert K. 08591
Arkansas
Peccary Cave, biostratigraphy, Mammalia: Davis, Leo Carson. 08698
Atlantic Ocean
Deep Sea Drilling Project, Leg 1, Foraminifera, Pleistocene sediments: Blow, W. H. 08539
Deep Sea Drilling Project, Leg 2, Pleistocene coccolithophores: Bukry, David. 01355
Deep Sea Drilling Project, Leg 2, Pleistocene Foraminifera, biostratigraphy: Blow, W. H. 01356
Deep Sea Drilling Project, Leg 1, Protista, Pleistocene sediments, age: Hay, W. W. 08538
Deep-sea cores, Pleistocene biostratigraphy: Cita, Maria B. 01359
Brachiopoda
Ecology, lingulids, sediment preference cf. Paleozoic: Paine, Robert T. 01378
California
Continental margin, Tanner Basin, Foraminifera: Kheradpir, Ahmad. 01302
Caribbean Sea
Sediment core: Bonatti, E. 08475
Georgia
Okefenokee Swamp, palynology, absolute age: Bond, T. A. 01380
Wayne County, Penholoway Fm., Pleistocene, type locality: Welby, Charles W. 08603
Gulf Coastal Plain
Sedimentation, depositional episodes, relation to sea-level changes: Frazier, David E. 08482
Gulf of Mexico
Deep Sea Drilling Project, Leg 1, Foraminifera, Pleistocene sediments: Blow, W. H. 08539
Deep Sea Drilling Project, Leg 1, Protista, Pleistocene sediments, age: Hay, W. W. 08538
Northern, Pleistocene climate, Foraminifera, temperature indicators: Beard, John H. 08552
Quaternary—Continued
Gulf of Mexico—Continued
Paleoclimatology, palynology: Elsik, William C. 08551
Paleoclimatology, Pleistocene, C-13:C-12 indicator: Rogers, M. A. 08478
Pleistocene, deep-sea cores, coccolith biostratigraphy: Bukry, David. 08548
Hawaii
Kau Desert quadrangle, Puna Volcanic Series: Walker, George W. 08676
Jamaica
Coastal Group, Foraminifera, Pleistocene, coiling directions: Robinson, E. 08479
Kansas
Doniphan County, surficial deposits, Pleistocene: Dort, Wakefield, Jr. 01070
McPherson County, Sandahl molluscan fauna, Illinoian: Miller, Barry B. 01372
Northeastern, loess deposits, Pleistocene: Caspall, Fred C. 01060
Manitoba
Riding Mountain area, palynology, Holocene lake sediment, climate: Ritchie, J. C. 08766
Massachusetts
Georgetown quadrangle, Pleistocene history: Cuppels, Norman P. 08792
New York
Little Falls-Richfield Springs area, Pleistocene history: Whipple, Janice M. 01245
Long Island shelf, micropaleontology, Pleistocene ecology: Gevirtz, Joel L. 01233
Northwestern, Glacial Great Lakes, chronology: Calkin, Parker E. 01384
Ohio
Fairlawn mastodon site, Pleistocene ecology: Teeter, James W. 01108
Garfield Heights, Pleistocene sediments: Miller, Barry B. 01088
Oregon
Coast Range and Willamette Valley, history: Snavely, P. D., Jr. 08717
Pacific Ocean
Cascadia Basin, paleoclimatology: Griggs, G. B. 01349
United States
Eastern, Mammalia, porcupine distribution: Ray, Clayton E. 01329
Pleistocene stages, correlation with New Zealand: Powers, William E. 01124
Washington
Horse Heaven Plateau, Mammalia, Touchet Beds, mammoth: Newcomb, R. C. 01192
King County, stratigraphy: Luzier, J. E. 08833
Olympic Peninsula, south-central, Pleistocene: Carson, Robert J., 3d. 01196
West Virginia
Morgantown area, palynology, Pleistocene: Parsons, Barbara Mae. 01222
Yukon
Snag-Klutlan area, Pleistocene: Rampton, Vernon Neil. 01242
Quebec
Maps, geologic
Gaspé Peninsula, northern coast: Enos, Paul. 08694
Maps, geologic index
Sheet 23: Canada Geological Survey. 01264
Petrology
La Trappe, Oka carbonatite, zoned micas, silicates, evolution: Rimsaite, Jadvyga. 08660

Quebec—Continued
Sedimentary petrology
Gaspé Peninsula, Cloridorme Fm., flysch, paleocurrents: Enos, Paul. 08694
Stratigraphy
Ordovician, Cloridorme Fm., Gaspé Peninsula: Enos, Paul. 08694
Structural geology
Gaspé Peninsula, Ordovician, folds and faults, Cloridorme flysch: Enos, Paul. 08694
Radar surveys
Missouri
Southeastern, Roselle fault lineament: Gillerman, Elliot. 01169
Radiolaria
Cretaceous-Quaternary
Atlantic Ocean, deep-sea cores, correlation: Cita, Maria B. 01359
Mesozoic
Bahamas, deep-sea cores, biostratigraphy: Pessagno, E. A., Jr. 08547
Tertiary
Atlantic Ocean, deep-sea cores, Eocene, description: Cita, Maria B. 01359
Gulf of Mexico, Atlantic Ocean, deep-sea sediments: Riedel, W. R. 08541
Radiowave methods
Application
Glaciers, thickness: Harland, Brian. 08700
Radiowave surveys
Greenland
Glacial ice, airborne echo sounding: Gudmandsen, P. 08769
Northwest Territories
Ellesmere Island glaciers, airborne sounding: Hattersley-Smith, G. 08701
Reefs
Louisiana
Cretaceous, Glen Rose Fm., clastic barrier form: McNamee, Donald F. 08433
Texas
Cretaceous, Glen Rose Fm., clastic barrier form: McNamee, Donald F. 08433
Remote-sensing methods
Applications
Oceans from space, symposium: Badgley, Peter C. 08691
Education
Pennsylvania State University: Lattman, Laurence H. 01186
General
NASA program, application: Badgley, Peter C. 08690
Interpretation
Sea-ice imagery, polar ice distinction: McLerran, James H. 08770
Multispectral photography
Ocean cartography, experimental techniques: Ross, D. S. 08689
Techniques
Sea-ice imagery, polar ice distinction: McLerran, James H. 08770
Rivers
Channel geometry
Bedforms, relation to seepage: Harrison, Samuel S. 01141
Oregon
Willamette and Tualatin Rivers, ancestral drainage: Parsons, Roger B. 08654
Sediment transport
Bed load, probabilistic characteristics: Paintal, Amreek Singh. 01277
Rivers—Continued
Sediment transport—Continued
Colorado, Clear Creek, sand tracer experiment: Kennedy, Vance C. 01294
Rocky Mountains
Economic geology
Oil shale, Green River Fm., genesis, modern analog: Bradley, W. H. 01250
Geomorphology
Uinta Mountains, landform analysis: Stevens, Dale John. 01227
Salt
Oregon
Occurrence, saline waters: Newton, V. C., Jr. 08749
Salt tectonics
Mechanism
Domes, simulation experiments: Howard, James Campbell. 01234
Sand
Oregon
Resources, silica: Ramp, Len. 08751
Tennessee
Vale quadrangle, Clayton and McNairy Fms.: Garman, R. Keith. 08802
Yuma quadrangle, occurrence: Sykes, C. Ronald. 08555
Sandstone
Pennsylvania
Carmichaels quadrangle, occurrence: Kent, Bion H. 08563
Mather quadrangle, occurrence: Kent, Bion H. 08790
Saskatchewan
Geophysical surveys
Southwestern, ground-water study, electrical: Dyck, John Henry. 01226
Maps, magnetic
Archibald Lake area, airborne: Canada Geological Survey. 01014
Attitti Lake area, airborne: Canada Geological Survey. 01004
Conjuring River area, airborne: Canada Geological Survey. 01029
Crean Lake area, airborne: Canada Geological Survey. 01006
Erickson Lake area, airborne: Canada Geological Survey. 01012
Glennie Lake area, airborne: Canada Geological Survey. 01028
Island Falls area, airborne: Canada Geological Survey. 01031
Kelly Lake area, airborne: Canada Geological Survey. 01024
Manawan Lake area, airborne: Canada Geological Survey. 01033
Marchel Lake area, airborne: Canada Geological Survey. 01034
Maynard Lake area, airborne: Canada Geological Survey. 01036
Montreal Lake South area, airborne: Canada Geological Survey. 01007
Nemei Lake area, airborne: Canada Geological Survey. 01035
Pelican Narrows area, airborne: Canada Geological Survey. 01003
Pinebluff Lake area, airborne: Canada Geological Survey. 01013
Red Bobs Lake area, airborne: Canada Geological Survey. 01011
Sandy Narrows area, airborne: Canada Geological Survey. 01002
Scarth River area, airborne: Canada Geological Survey. 01010

Saskatchewan – Continued
Maps, magnetic – Continued
Scimitar Lake area, airborne: Canada Geological Survey. 01026
Settee Lake area, airborne: Canada Geological Survey. 01023
Sheet 63 M:16, airborne: Canada Geological Survey. 01027
Steephill Lake area, airborne: Canada Geological Survey. 01025
Strange Lake area, airborne: Canada Geological Survey. 01005
Summit Lake area, airborne: Canada Geological Survey. 01009
Trade Lake area, airborne: Canada Geological Survey. 01032
Whiteswan Lakes area, airborne: Canada Geological Survey. 01008
Wintego Lake area, airborne: Canada Geological Survey. 01030
Sedimentary petrology
Southwestern, Viking Fm., sandstone members, imbrication, linearity: Evans, W. E. 01128
Winnipegosis Fm., diagenesis: Shearman, D. J. 08763
Stratigraphy
Devonian, Winnipegosis Fm., Elk Point salt basin: Shearman, D. J. 08763
Sea water
Composition
Gold content, analyses, compilation: Jones, Robert S. 01315
Geochemistry
Foraminifera solution, lysocline, Pacific Ocean: Berger, Wolfgang H. 01348
Uranium, abundance, isotopes, Gulf of Mexico: Sackett, W. M. 08519
Sedimentary rocks
Bentonite
Petrology, United States, Tioga Bentonite: Textoris, Daniel A. 01179
Carbonate rocks
Genesis, travertine, Arizona, Montezuma Well: Cole, Gerald A. 08607
Clastics
General description, British Columbia, Sustut and Bowser Fms.: Allen, Gary Wayne. 01168
Petrology, Arizona, Tucson Mtn. Park, fragmental diapir: Mayo, Evans B. 08644
Conglomerate
Provenance, Idaho, Oregon, Triassic, granitic clasts: Vallier, Tracy L. 01110
Depositional environments
Dipmeter interpretation: Gilreath, J. A. 08524
Interpretation from physical attributes of calcareous particles: Pilkey, Orrin H. 08438
Jurassic, Upper, carbonates as indicators, Texas: Dickinson, Kendell A. 08522
Texas, north-central, Cisco Group, sandstones: Brown, L. F., Jr. 08434
Dolomite
Physical properties, microsucrosic, permeability anisotropy: Roehl, Perry O. 08452
General
Diagenesis, clay minerals, effects, Oklahoma: Bucke, David Perry, Jr. 01228
General description, Maryland, Harford County, Cretaceous-Cenozoic: Owens, James P. 08827
Petrology, provenance, Quebec, Gaspé Peninsula, Cloridorme Fm.: Enos, Paul. 08694
Lithofacies
Appalachians, central, Upper Ordovician, nomenclature: Thompson, Allan M. 01147
Sedimentary rocks – Continued
Lithofacies – Continued
Bahamas, San Salvador Island, core: Supko, Peter R. 08484
Illinois, Salem, St. Louis Limestones: Lineback, Jerry A. 01081
Texas, north-central, Cisco Group, sandstones: Brown, L. F., Jr. 08434
Wisconsin, western, Franconia Fm.: Dapples, E. C. 01067
Methods
Kerogen characterization by pyrolysis and chromatography: Giraud, A. 01126
Mudrock
Alteration, incipient metamorphism, effect on organic matter: Baker, Donald R. 01127
Physical properties
Porosity, compaction features, depth relations: Brown, Philip R. 08847
Sandstone
Alteration, Permian formations, Arizona: Peirce, H. Wesley. 08593
Mineral composition, Minnesota, Wisconsin, Franconia Fm.: Odom, I. Edgar. 01094
Petrology, Washington, Swauk Fm., high silica: Lowther, J. Stewart. 01198
Shale
Compaction features, terrigenous, cf. carbonate rocks: Brown, Philip R. 08847
Petrology, Wyoming, Mowry Shale: Davis, John Clements. 01129
Physical properties, multiple logging, computer analysis: Konen, C. E. 01271
Structural features, fault-grading, California, Monterey Shale: Seilacher, Adolf. 08821
Sedimentary structures
Biogenic
Anthozoan burrows, Holocene, North Carolina beaches: Frey, R. W. 01279
Current markings
Quebec, Gaspé Peninsula, Cloridorme Fm.: Enos, Paul. 08694
Imbrication
Saskatchewan, Viking Fm., linear sandstone members: Evans, W. E. 01128
Oolites
Georgia, chamosite-hematite, Sequatchie Fm.: Chowns, T. M. 01320
Slump structure
Newfoundland, Ordovician sediments: Helwig, James. 01121
Sedimentation
Environment
Atoll lagoon, Caribbean Sea, southwestern: Milliman, John D. 08445
Continental shelf, calcareous particles, significance of physical attributes: Pilkey, Orrin H. 08438
Continental shelf, Quaternary, grading: Swift, Donald J. P. 01377
Delta, depositional episodes, relation to sea-level changes: Frazier, David E. 08482
Delta, identification of paleodispersal centers: Long, Sumner. 01324
Delta, Yukon, Blow River: McCloy, James Murl. 01184
Experimental studies
Foraminiferal death assemblages, solution, lysocline: Berger, Wolfgang H. 01348
Hydrodynamic forces, sediments, effluent, influent seepage, effects: Rao, Manam Venkata Panduranga. 01249

Sedimentation—Continued
Experimental studies—Continued
Rivers, bedforms, relation to seepage: Harrison, Samuel S. 01141
Ocean currents
Beach sand movement, quantitative analysis, Virginia: Boon, John D., 3d. 08662
Continental slope, off Cape Hatteras, N. C.: Rona, Peter A. 01120
Storm surges, barrier islands, washover fans: Pierce, J. W. 01125
Rates
Georgia, Piedmont, culturally-accelerated: Trimble, Stanley W. 01332
Stream transport
Bed load, probabilistic characteristics, alluvial channels: Paintal, Amreek Singh. 01277
Sand, tracer experiment, Colorado, Clear Creek: Kennedy, Vance C. 01294
Turbidity currents
Abyssal plain genesis, pelagic sediment redeposition: Conolly, John R. 08550
Quaternary basins, California-Baja California margin: Moore, David G. 08669
Sediments
Carbonate
Compaction, porosity-depth relationships: Brown, Philip R. 08847
Consolidation-compression experiments, Bahamas: Miller, Donald G., Jr. 08661
Distribution, shallow shelf environment, control: Moore, Clyde H., Jr. 08476
General description, Caribbean Sea, atoll lagoons: Milliman, John D. 08445
Environment
Continental shelf, calcareous particles, significance of physical attributes: Pilkey, Orrin H. 08438
General
Biostratigraphy, coccoliths, deep-sea: Bukry, David. 08548
Deep-sea, Drilling Project, Leg 2, Atlantic Ocean: Peterson, Melvin N. A. 01268
Effect on water quality: Grissinger, E. H. 01375
General description, Lake Michigan: Collinson, Charles. 01064
General description, New York, Long Island, shelf: McKinney, Thomas Francis. 01239
General descriptions, deep-sea cores, thin-section data: Wood, G. V. 08536
Geochemistry, deep-sea cores, carbon, organic and carbonate, Atlantic Ocean: Deep Sea Drilling Project. 01385
Mineral composition, deep-sea cores, X-ray diffraction, Atlantic Ocean: Rex, R. W. 01354
Sedimentology, deep-sea: Beall, A. O., Jr. 08545
Thin section data, deep-sea cores, Atlantic Ocean: Wood, G. V. 01353
Geochemistry
Alaska, glaciomarine-sea water interactions: Sharma, Ghanshyam D. 01139
Atlantic Ocean, deep-sea cores, interstitial water: Kaplan, I. R. 01357
Carbon and carbonate content, Gulf of Mexico, Atlantic Ocean: Deep Sea Drilling Project. 08535
Deep-sea, core samples, interstitial-water studies: Kaplan, I. R. 08543
Deep-sea, core samples, interstitial-water studies: Manheim, F. T. 08542
Water content, deep-sea, Gulf of Mexico, Atlantic Ocean: Deep Sea Drilling Project. 08534
Sediments—Continued
Gravel
General description, Maryland, Harford County: Owens, James P. 08827
Lithofacies
Gulf Coastal Plain, Quaternary depositional episode and sequence: Frazier, David E. 08482
Mexico, Cuenca de Burgos, Oligocene: Rodríquez Santana, E. 08617
Michigan, southern peninsula, glacial: Wingard, Norman E. 01113
Lutite
Mineral composition, provenance, Pacific Ocean off Oregon: Duncan, John R. 01122
Methods
Grain-size analysis, deep-sea cores: Deep Sea Drilling Project. 08533
Sediment distribution map, construction, application: Bouma, Arnold H. 08444
Weighing, nondestructive wet, marine samples: Wilde, P. 01346
Mineral composition
X-ray diffraction analyses, deep-sea core studies: Rex, R. W. 08537
Mud
Compaction, porosity-depth relationships: Brown, Philip R. 08847
Physical properties
Nuclear magnetic resonance technique: Kumar, J. 01272
Seismites
Genesis, fault-graded beds: Seilacher, Adolf. 08821
Seismic methods
Applications
Mine subsidence, seismo-acoustic measurements: Pomeroy, Paul W. 08784
Instruments
Profiling systems, deep-water, advances: Luehrmann, William H. 08803
Interpretation
Optical filtering, laser beam: Instituto Mexicano del Petróleo. 08616
Seismic array calibration, explosion experiment, Northwest Territories: Weichert, D. H. 08613
Seismic surveys
California
Continental margin, southern, tectonics, sedimentation: Moore, David G. 08669
Gulf of Mexico
North Florida Platform: Antoine, John W. 08449
Illinois
Mississippi River, bedrock channel, ancient: McGinnis, L. D. 01084
Mexico
Continental margin, Baja California, tectonics, sedimentation: Moore, David G. 08669
Cuenca de Burgos, exploration, deep tectonics: Chavira, F. C. 08619
Cuenca de Veracruz, sections, interpretation: Acosta Ojinaga, R. 08683
Veracruz, Ahuatepec-Aragon area, velocity measurements: Oñate Espinosa, R. 08623
Yucatan, petroleum exploration: Oñate Espinosa, R. 08680
Northwest Territories
Crustal studies, Yellowknife array calibration: Weichert, D. H. 08613

Shorelines
North Carolina
Barrier islands, washover fans, inlets, storm surge genesis: Pierce, J. W. 01125
Silurian
Florida
Protista, chitinozoans: Goldstein, Robert F. 08525
Indiana
Southeastern, Foraminifera: Noland, Anne Vinson. 01116
Kentucky
North-central, Foraminifera: Noland, Anne Vinson. 01116
Manitoba
Northern, biostratigraphy: Norford, B. S. 01133
Michigan
Michigan basin, Niagaran reefs: Burgess, R. J. 01288
Nevada
Central, Brachiopoda, Tor Limestone, age: Johnson, J. G. 01212
New York
Niagara region, Bryozoa, cf. England, Sweden, paleogeography: Owen, David E. 08671
Ohio
Bass Islands, Bass Islands Fm., members: Sparling, Dale R. 01351
Silver
Oregon
Blue Mountains and western, occurrence, potential: Brooks, H. C. 08732
Snow
General
Research, Greenland, Camp EGIG to Station Jarl-Joset: deQuervain, Marcel. 08841
Sodium carbonate
Oregon
Lake County, occurrence, reserves of anhydrous: Mason, R. S. 08752
Soils
Mapping
Plant distribution indicators, Arizona, Swisshelm Mts.: Bradbury, David. 08583
New Mexico
High plains, caliche profiles, genesis, analyses: Aristarain, L. F. 01123
Oregon
Lake Oswego area, geomorphic surfaces: Parsons, Roger B. 08654
Pennsylvania
Erie, Jefferson Counties: Kohland, William Francis. 01221
Physical properties
Stress-strain characteristics, linear viscoelastic model: Whitman, Robert V. 01178
Washington
Central, chemical properties, seasonal variation: Anderson, T. D. 01194
South Carolina
Engineering geology
Waste disposal, Savannah River Plant, tracer test: Webster, D. S. 01370
Mineralogy
Chlorite, northwestern, polytypism: Manley, F. H. 01333
South Dakota
Economic geology
Metals, Galena-Roubaix district, exploration: Bayley, R. W. 01374
South Dakota—Continued
Maps, geologic
Galena-Roubaix district: Bayley, R. W. 01374
Paleontology
Foraminifera, Cretaceous, Turonian beds, new heterohelicid: Eicher, Don L. 01301
Stratigraphy
Precambrian, Galena-Roubaix district: Bayley, R. W. 01374
Structural geology
Galena-Roubaix district, folds: Bayley, R. W. 01374
Spectroscopy
Absorption
Atomic, silicate analysis, lithium metaborate fusion: VanLoon, J. C. 08610
Activation analysis
Molybdenite, rutile, wolframite, in porphyry copper: Kuck, Peter. 08587
Electron probe
Garnet, zoned, data: Brown, Edwin H. 08498
Melanite, zoned, Ti-rich, data: Gomes, Celso de Barros. 08497
Nannofossil research: Charm, Walter B. 01134
Use with scanning electron microscopy: Radcliffe, Dennis. 01328
Emission
Ruby-bearing nodules, Georgia: Giardini, A. A. 01321
General
Technique, Mineral Constitution Labs., Pennsylvania State Univ.: Bell, Maurice E. 08693
Infrared
Montmorillonite, fixation of hydroxy-aluminum: Gupta, G. C. 08494
Palygorskite, data: Hayashi, Hisato. 08493
Sepiolite, data: Hayashi, Hisato. 08493
X-ray fluorescence
Technique, stratigraphic samples, oil well: Limón Gutiérrez, L. 08685
Statistical measures
Trend-surface analysis
Significance test: Chayes, Felix. 01145
Statistical methods
Bibliography
Automatic data processing: McIntyre, Donald B. 08816
Economic geology
Factor analysis, magnetite, formation mode, distribution: Zodrow, Erwin L. 01318
Sample normality tests, petroleum exploration, computer program: Preston, D. A. 01118
General
Data matrices: McIntyre, Donald B. 08815
Population models: Krumbein, W. C. 08811
Probability, models, random processes: Krumbein, W. C. 08812
Variance analysis, application to geology: Kauffman, Marvin E. 08813
Variance analysis, application to geology, multivariate methods: McCammon, Richard B. 08814
Magnetic methods
Frequency analysis, aeromagnetic data, statistical models: Spector, A. 01259
General, aeromagnetic field, statistical structure: Naidu, Prabhakar S. 01258
Paleoecology
Cluster analysis, distortion, measurement: Kaesler, Roger L. 01146

Statistical methods—Continued
Paleontology
Variance analysis, conodonts: Barnett, Stockton G. 01051
Variance analysis, Paleozoic Bryozoa, taxonomy: Anstey, Robert L. 01219
Petrology
Trend-surface analysis, significance test: Chayes, Felix. 01145
Stratigraphy
Methods
Biostratigraphy, strata subdivision: Leutze, W. P. 08471
Nomenclature
Changes, 1968, U.S. Geological Survey: Cohee, George V. 01373
Structural geology
Methods
Orientation data analysis, use of computer: LaFountain, Lester J. 01144
Surveys
California Division Mines and Geology
Gravity program, summary: Chapman, Rodger H. 08574
Joint Oceanog. Inst. Deep Earth Sampling
Deep Sea Drilling Project, Leg 2: Peterson, Melvin N. A. 01268
Oregon State University
Gravity program, North America, western: Couch, R. W. 08578
Princeton University
Gravity program since 1965, Montana, Wyoming: Bonini, William E. 08600
Texas
History, geology and politics, 1845-1909: Ferguson, Walter Keene. 08825
United States Coast and Geodetic Survey
Crustal deformation, recent, monitoring program: Whitten, Charles A. 08785
National Gravity Base Net: Schwimmer, Philip M. 08569
United States Geological Survey
Gravimeter calibration, mountain loops: Barnes, David F. 08570
Gravity program, California, since 1963: Oliver, Howard W. 08575
Gravity program since 1964, United States, western: Kleinkopf, M. Dean. 08601
Research, San Andreas fault system, tectonics: Pakiser, L. C. 08831
Wyoming University
Gravity program, Wyoming, Colorado: Smithson, Scott B. 08573
Symposia
American Geophysical Union
Gravity surveys, western N. Am., 1968: Barnes, David F. 08567
American Society of Oceanography, and others
Oceans from space: Badgley, Peter C. 08691
Automatic data processing
Mineral industry: Weiss, Alfred. 08503
Petroleum and natural gas exploration
Methods, unconventional: Heroy, William B. 08764
Royal Geographical Society
Glacier sounding in polar regions: Harland, Brian. 08700
Tectonics
Areal studies
Alaska, Texas, isallo stress analysis: Ranken, R. E. 08612

Tectonics—Continued
Areal studies—Continued
Appalachians, role of plate tectonics: Bird, John M. 01137
Atlantic Ocean, plate tectonics, pole of rotation: Horsfield, W. T. 01300
Atlantic Ocean, sea-floor spreading rate: Peterson, M. N. A. 01360
Bahamas, subsidence, relation to sea-floor spreading rate: Lynts, George W. 01295
California, Leech Lake Mtn.-Anthony Peak region, Franciscan rocks: Suppe, John Edward. 01244
California, San Andreas fault system: Eaton, J. P. 08829
California, San Andreas fault system: Pakiser, L. C. 08831
California-Baja California, continental margin, Miocene, seismic data: Moore, David G. 08669
Caribbean region, Nicaraguan Rise: Arden, Daniel D., Jr. 08459
Caribbean-Central American relations: Dengo, Gabriel. 08529
Florida, northern, Cenozoic uplift: Hoyt, John H. 08517
New York-Vermont, Taconic region, gravity sliding: Bird, John M. 08843
Ontario, Sudbury area, Grenville front: Brown, Jim McCaslin. 01057
United States, major provinces cf. seismic noise distribution: Poort, Jon M. 01327
Methods
Photogeology, surface faulting, rate and nature: Slemmons, David B. 08781
Processes
Global tectonics, mechanics, causes: Sykes, Lynn R. 08780
Sea-floor spreading, continental drift, research since 1969: Vine, F. J. 01344
Sea-floor spreading, migration and shear, Mid-Atlantic Ridge: Ball, M. M. 08528
Tennessee
Economic geology
Coal, Jellico West quadrangle, beds: Englund, Kenneth J. 08793
Coal, limestone, Welchland quadrangle, occurrence: Garman, R. Keith. 08559
Limestone, Baileyton quadrangle, occurrence: Finlayson, C. Pratt. 08554
Limestone, chert, Cumberland Springs quadrangle, occurrence: Wilson, Charles W., Jr. 08557
Sand, Vale quadrangle, Clayton and McNairy Fms.: Garman, R. Keith. 08802
Sand, Yuma quadrangle, occurrence: Sykes, C. Ronald. 08555
Maps, geologic
Baileyton quadrangle: Byerly, Don W. 08558
Cumberland Springs quadrangle: Wilson, Charles W., Jr. 08557
Jellico West quadrangle: Englund, Kenneth J. 08793
Vale quadrangle: Garman, R. Keith. 08802
Welchland quadrangle: Garman, R. Keith. 08559
Yuma quadrangle: Brown, Donald L. 08556
Paleontology
Cystoidea, Devonian, Birdsong Shale, Decatur County: Smith, Michael Oglesby. 01330
Stratigraphy
Cambrian-Ordovician, Baileyton quadrangle, section: Byerly, Don W. 08558

Tennessee – Continued
Stratigraphy – Continued
Ordovician-Pennsylvanian, Jellico West quadrangle, section: Englund, Kenneth J. 08793
Tertiary
Alabama
Bashi Marl Member of Hatchetigbee, Cocoa Sand Member of Yazoo Clay, type locality: Welby, Charles W. 08603
Alaska
Alaska Range, central, Cantwell Fm., Paleocene, nomenclature: Wolfe, Jack A. 01313
Arizona
Empire Mountains quadrangle, Pantano Fm., new: Finnell, Tommy L. 01311
Sedona-Rimrock area, Hickey Fm., revision: Scholtz, Judith Fessenden. 08609
Atlantic Ocean
Blake-Bahama basin, Bermuda rise, coccolith biostratigraphy: Bukry, David. 08548
Deep Sea Drilling Project, Leg 1, Bermuda Rise, Radiolaria: Riedel, W. R. 08541
Deep Sea Drilling Project, Leg 2, biostratigraphy: Peterson, M. N. A. 01371
Deep Sea Drilling Project, Leg 2, coccolithophores, age diagnostic: Bukry, David. 01355
Deep Sea Drilling Project, Leg 2, Foraminifera, biostratigraphy: Blow, W. H. 01356
Deep Sea Drilling Project, Leg 1, Foraminifera, biostratigraphy: Blow, W. H. 08539
Deep Sea Drilling Project, Leg 1, Foraminifera, larger: Sachs, K. N., Jr. 08540
Deep Sea Drilling Project, Leg 1, Protista, calcareous, age: Hay, W. W. 08538
Deep-sea cores, biostratigraphy: Cita, Maria B. 01359
British Columbia
Allenby Fm., plants, Eocene: Arnold, Chester A. 01048
Correlation
Eocene boundaries, criteria for internat. standard section: Hay, William W. 08646
Miocene, *Orbulina* datum, tropical vs. temperate areas: Bandy, Orville L. 08647
Paleogene series-epochs of Lyell, vs. stage and zone refinements: Weaver, D. W. 08645
Florida
Cedar Keys Limestone, Chipola Formation, type localities: Welby, Charles W. 08603
Gulf Coastal Plain
Alabama-Mississippi, Eocene, Bryozoa-Anthozoa intergrowths: Greeley, Ronald. 01218
Biostratigraphy, importance for subdividing: Leutze, W. P. 08471
Mollusca, Echinoidea, guide fossils, Paleocene-Eocene: Toulmin, Lyman D. 08469
Gulf of Mexico
Deep Sea Drilling Project, Foraminifera, biostratigraphy: Blow, W. H. 08539
Deep Sea Drilling Project, Leg 1, Site 3, Radiolaria: Riedel, W. R. 08541
Deep Sea Drilling Project, Protista, calcareous, age: Hay, W. W. 08538
Paleoclimatology, palynology: Elsik, William C. 08551
Pliocene, deep-sea cores, coccolith biostratigraphy: Bukry, David. 08548
Hawaii
Kau Desert quadrangle, Hilina Volcanic Series: Walker, George W. 08676
Tertiary – Continued
Jamaica
Coastal Group, Foraminifera, coiling directions: Robinson, E. 08479
Louisiana
Montgomery, Cephalopoda, Jackson fm.: Gimbrede, Louis de A. 08477
Mexico
Continental platform, Gulf of Mexico, biostratigraphy: Gómez Ponce, M. 08629
Cuenca de Burgos, Oligocene sediments, lower: Sandoval C., M. J. 08618
Tamaulipas, Oligocene, upper, Foraminifera: Riva Palacio, E. 08684
Mississippi
Attala County, Bucksnort Hill, Zilpha Clay, type locality: Welby, Charles W. 08603
New Jersey
Coastal plain, Eocene sediments, stratigraphy: Enright, Richard Louis Charles, Jr. 01231
Oregon
Angiosperms, Eocene-Oligocene, palms: Gregory, Irene. 08688
Bandon area, silicoflagellates, Miocene diatomite, cf. California: Orr, William N. 01191
Cedar Butte area, stratigraphy and volcanism: Nelson, Dennis O. 08686
Clarno Fm., plants, Eocene: Arnold, Chester A. 01048
Coast Range and Willamette Valley, history: Snavely, P. D., Jr. 08717
Crook County, Angiosperms, Clarno Fm.: Gregory, Irene. 08653
Newport area, stratigraphy: Snavely, Parke D., Jr. 08649
Puerto Rico
Southern, Ostracoda, Ponce Fm. and Lajas Valley limestone, correlation: Bold, W. A. van den. 08820
Utah
Summit County, Mammalia, Green River Fm.: Parker, Lee R. 01095
Uinta Basin, tracks and trails, nematode, Green River Fm.: Moussa, Mounir T. 01216
Texas
Economic geology
Petroleum, Frio formation, exploration, depositional history: Martin, Gene B. 08470
Uranium, southern, occurrence, review: Petersen, W. A. 08451
Engineering geology
Land use, coastal, environmental geology atlas: Flawn, Peter T. 01383
General
History, 1845-1909, geology and politics: Ferguson, Walter Keene. 08825
Geochemistry
Terlingua district, geochemical prospecting, mercury: Geddes, Richard W. 01232
Hydrogeology
Angelina-Nacogdoches Counties, ground-water resources: Guyton, William F., and Associates. 01368
Bastrop County, ground-water resources: Follett, C. R. 01256
Maps, hydrogeologic
Angelina-Nacogdoches Counties: Guyton, William F., and Associates. 01368
Bastrop County: Follett, C. R. 01256

Texas—Continued
Paleontology
Cephalopoda, Pennsylvanian, Magdalena Fm., western, arctic ammonoid: Nassichuk, W. W. 01220
Sedimentary petrology
Lower Cretaceous carbonate sequences, distribution, controls: Moore, Clyde H., Jr. 08476
North-central, Cisco Group, sandstones, facies, geometry, distribution: Brown, L. F., Jr. 08434
Southern, Frio formation, depositional history: Martin, Gene B. 08470
Stratigraphy
Cretaceous, Glen Rose reef complex: McNamee, Donald F. 08433
Jurassic, Upper: Dickinson, Kendell A. 08522
Structural geology
Tectonic stresses, isallo stress analysis: Ranken, R. E. 08612
Thermal springs
Washington
Classification, compositions: Campbell, K. Vincent. 01190
Wyoming
Yellowstone National Park, waters, V, Mo contents: Araki, Tadashi. 08839
Thermodynamic properties
Basalt
Mechanisms in melting range: Shaw, Herbert R. 08566
Magnesium silicate
Dissolution: Luce, Robert William. 01237
Manganese
Fractionation, fugacity and temperature effects: Dasgupta, H. C. 01183
Thorium
Geochemistry
Caribbean Sea, Cariaco Trench, sediment cores: Rona, Elizabeth. 08527
Wyoming, Minnesota, Precambrian graywackes: Rogers, J. J. W. 01171
Titanium
Oregon
Occurrence, potential: Herz, Norman. 08739
Trace-element analyses
Basalt
Argon, excess in pillow: Dymond, Jack. 01136
Gold
Water, plants, and animals: Jones, Robert S. 01315
Thermal spring waters
Wyoming, Yellowstone National Park, V, Mo: Araki, Tadashi. 08839
Tracks and trails
Anthozoa
Holocene, North Carolina beaches, anemone burrows: Frey, R. W. 01279
Oregon
Eocene, Clarno Fm., worm tube in poplar wood: Gregory, Irene. 08653
Worms
Eocene, Utah, Uinta Basin, Green River Fm., nematode: Moussa, Mounir T. 01216
Trilobita
Ordovician
Virginia, Arvonia Slate, Arvonia district: Tillman, C. G. 01140
Tungsten
Oregon
Resources: Hobbs, S. W. 08740
Unconformities
Arizona
Tertiary, basalt units, Sedona-Rimrock area, beveled Paleozoic strata: Scholtz, Judith Fessenden. 08609
United States
Absolute age
C-14, general listing, ISOTOPES laboratory: Buckley, James D. 01336
C-14, general listing, Smithsonian laboratory: Stuckenrath, Robert, Jr. 01338
C-14, general listing, Univ. Michigan laboratory: Crane, H. R. 01381
C-14, general listing, Univ. Texas laboratory: Valastro, S., Jr. 01340
C-14, general listing, Univ. Wisconsin laboratory: Bender, Margaret M. 01339
C-14, general listing, U.S. Geological Survey laboratory: Sullivan, Beverly Marsters. 01382
Areal geology
Midwestern, early travelers' observations, 1750-87: White, George W. 08760
General
National water atlas, proposal: Heindl, L. A. 01379
Geomorphology
Midcontinent, bison trails, distinguished from joint traces: Clayton, Lee. 01061
Geophysical surveys
Gravimeter calibration, mountain loops, U.S. Geol. Survey: Barnes, David F. 08570
National Gravity Base Net: Schwimmer, Philip M. 08569
Western, U.S. Geol. Survey gravity program, since 1964: Kleinkopf, M. Dean. 08601
Hydrogeology
Northeastern, ground-water levels, 1963-67: U.S. Geological Survey. 01262
Southeastern, comparative method, classification of settings: LeGrand, Harry E. 01149
Paleontology
Blastoidea, Crinoidea, Carboniferous, southwestern, index value: Webster, G. D. 01214
Conodonts, Carboniferous, Chester-Morrow, western, phylogeny: Dunn, D. L. 01217
Mammalia, Quaternary, porcupine, eastern, distribution: Ray, Clayton E. 01329
Mississippian, Chester Series, Illinois basin, biotic diversity: Horowitz, Alan Stanley. 01075
Palynology, Devonian, eastern, midcontinent: Norton, Norman J. 01093
Sedimentary petrology
Appalachians to midwest, Cambrian sedimentation: Prouty, C. E. 01097
Northeastern, midwest, Tioga Bentonite: Textoris, Daniel A. 01179
Stratigraphy
Cambrian-Ordovician, boundary, age discrepancies: Miller, James F. 01089
Carboniferous, Chester-Morrow sections, western: Dunn, D. L. 01217
Pleistocene, stages, correlation with New Zealand: Powers, William E. 01124
Structural geology
Midcontinent, basement relief beneath Upper Cambrian: Meyerhoff, Howard A. 01087
Tectonic provinces, major, cf. seismic noise distribution: Poort, Jon M. 01327

Uplifts
Rate
Estimation, river basin denudation rate and relief relations: Ahnert, Frank. 08844
Uranium
Abundance
Gulf of Mexico, waters: Sackett, W. M. 08519
Arizona
Shiprock area, resource prediction, computer processing: Bostick, Neil H. 01316
Exploration
Resource prediction, computer process: Bostick, Neil H. 01316
Geochemistry
Caribbean Sea, Cariaco Trench, sediment cores: Rona, Elizabeth. 08527
Wyoming, Minnesota, Precambrian graywackes: Rogers, J. J. W. 01171
Isotopes
U-234:U-238, Gulf of Mexico waters: Sackett, W. M. 08519
New Mexico
Shiprock area, resource prediction, computer processing: Bostick, Neil H. 01316
North America
Resources, occurrence, future possibilities: Robertson, David S. 08805
Oregon
Southern and central, resources, production: Peterson, N. V. 08741
Texas
Southern, occurrence, review: Petersen, W. A. 08451
Utah
Geophysical surveys
Published, unpublished gravity data, summary: Cook, Kenneth L. 08598
Mineralogy
Bindheimite, bismuthian, Eureka: Montoya, J. 08500
Paleontology
Crinoidea, Carboniferous, n. spp., index value: Webster, G. D. 01214
Mammalia, Eocene, Green River Fm., Summit County: Parker, Lee R. 01095
Tracks and trails, Eocene, Green River Fm., nematode: Moussa, Mounir T. 01216
Structural geology
Arches National Monument, Carmel Fm., folds, mechanism: Johnson, Arvid M. 08611
Red Canyon area, Sevier fault, vegetation distribution as indicator: Brooks, William H. 01201
Vanadium
Geochemistry
Thermal spring waters, Wyoming, Yellowstone Natl. Park: Araki, Tadashi. 08839
Oregon
Occurrence: Fischer, R. P. 08742
Vermont
Structural geology
West-central, gravity sliding, Taconic region: Bird, John M. 08843
Vertebrata
General
Louisiana, Mississippi, bibliography, list, index: Domning, Daryl P. 08464
Virginia
Areal geology
Great Falls area, guidebook: U.S. Geological Survey. 01153
Virginia – Continued
Engineering geology
Highways, Chesapeake Bay bridge-tunnel, problems: Sverdrup, Leif J. 08674
Paleontology
Trilobita, Ordovician, Arvonia Slate, Arvonia district: Tillman, C. G. 01140
Sedimentary petrology
Virginia Beach, beach sand movement, quantitative analysis: Boon, John D., 3d. 08662
Volcanism
Base-surge deposition
Maar volcanoes: Fisher, Richard V. 01177
Mechanism
Ash flows, eruptive processes, products: Peterson, Donald W. 01341
Volcanoes
Honduras
History, since Paleozoic: Williams, Howel. 08708
Oregon
Newberry Volcano, Holocene flows, age: Peterson, N. V. 08687
Washington
Mount Saint Helens, Y ash layer, distribution: Norgren, J. A. 01200
Washington
Geochemistry
Central, soils, chemical properties, seasonal variation: Anderson, T. D. 01194
Geophysical surveys
Princeton University gravity program, since 1965: Bonini, William E. 08600
Western, Washington Univ. gravity program: Christensen, Nikolas I. 08580
Glacial geology
Olympic Peninsula, south-central, Pleistocene: Carson, Robert J., 3d. 01196
Hydrogeology
King County, Duwamish Valley, ground-water resources: Luzier, J. E. 08833
Thermal springs, classification, compositions: Campbell, K. Vincent. 01190
Maps, hydrogeologic
King County, southwestern: Luzier, J. E. 08833
Paleontology
Mammalia, Quaternary, Touchet Beds, Horse Heaven Plateau, mammoth: Newcomb, R. C. 01192
Petrology
South-central, Mount Saint Helens Y ash layer, distribution: Norgren, J. A. 01200
Sedimentary petrology
Wenatchee area, Swauk Fm., silica sandstones: Lowther, J. Stewart. 01198
Stratigraphy
Cenozoic, Camas area, Prune Hill, paleogeography: Aviolo, Gennara. 01195
Quaternary, King County: Luzier, J. E. 08833
Structural geology
Southeastern, Touchet Beds, clastic dikes, permafrost crevices: Alwin, John A. 01193
Weathering
Caliche soils
Genesis, analyses, New Mexico: Aristarain, L. F. 01123
Well logging
Acoustical
Instrumentation, borehole televiewer: Zemanek, Joe. 01257
Electrical
Deep Sea Drilling Project, Leg 1: Ewing, M. 08532

Well logging—Continued
Electrical—Continued
Interpretation, Deep-Sea Drilling Project, Leg 1: Kennedy, K. F. 08604
Interpretation, Hawaii, basaltic aquifers: Peterson, Frank L. 01155
Marine sediment cores, cf. physical property studies: Chmelik, Frank B. 08435
General
Multiple porosity logging, sandy shale, computer analysis: Konen, C. E. 01271
Radioactivity
Data, Atlantic Ocean, Deep Sea Drilling Project: Peterson, M. N. A. 01371
Deep Sea Drilling Project, Leg 1: Ewing, M. 08532
Interpretation, Deep-Sea Drilling Project, Leg 1: Kennedy, K. F. 08604
Wells and drill holes
Atlantic Ocean
Bahama platform-Hatteras plain, cores: Ewing, M. 08532
Deep Sea Drilling Project, Leg 2, cores: Peterson, M. N. A. 01371
Canada
Western, core and sample storage, depositories: Pow, J. R. 08762
Gulf of Mexico
Sigsbee deep, cores: Ewing, M. 08532
Texas
Angelina-Nacogdoches Counties, well and spring records, drillers' logs: Guyton, William F., and Associates. 01368
Bastrop County, well and spring records, drillers' logs: Follett, C. R. 01256
West Indies
Structural geology
Greater Antilles, major east-west fractures: MacDonald, William D. 08818
West Virginia
Absolute age
Morgantown area, Pleistocene wood, C-14: Parsons, Barbara Mae. 01222
Paleontology
Palynology, Pleistocene, Morgantown area: Parsons, Barbara Mae. 01222
Wisconsin
Glacial geology
Lake Michigan lobe, Valders drift border, revision: Farrand, William R. 01187
Hydrogeology
Rock-Fox River basin, water resources: Cotter, R. D. 08765
Maps, hydrogeologic
Rock-Fox River basin: Cotter, R. D. 08765
Sedimentary petrology
Western, Franconia Fm., lithofacies: Dapples, E. C. 01067
Western, Franconia Fm., mineral composition: Odom, I. Edgar. 01094
Worms
Tertiary
Utah, Uinta Basin, Green River Fm., nematode trails: Moussa, Mounir T. 01216
Wyoming
Economic geology
Mineral resources, Granite Mts. area: Love, J. D. 01293
Wyoming—Continued
Economic geology—Continued
Petroleum, natural gas, Powder River basin, Hilight field: Tesone, V. P. 01314
Geochemistry
Wind River Mountains, Precambrian rocks, Th:U ratios: Rogers, J. J. W. 01171
Yellowstone National Park, hot springs, V, Mo contents: Araki, Tadashi. 08839
Geomorphology
Absaroka Mountains, Galena Creek area, rock glaciers: Potter, Noel, Jr. 01241
Sublette County, hillslopes, overland flow hydraulics: Emmett, William W. 01363
Geophysical surveys
Princeton University gravity program, since 1965: Bonini, William E. 08600
Wyoming University, gravity program: Smithson, Scott B. 08573
Maps, geologic
Granite Mountains area: Love, J. D. 01293
Maps, structure
Granite Mountains area, Tertiary: Love, J. D. 01293
Sedimentary petrology
Mowry Shale: Davis, John Clements. 01129
Stratigraphy
Cenozoic, Granite Mountains area: Love, J. D. 01293
Structural geology
Granite Mountains area: Love, J. D. 01293
X-ray diffraction analysis
Data
Cordierite, distortion index: Zeck, Hubert P. 08501
Cordierite, first meteoritic occurrence, Allende: Fuchs, Louis H. 08496
Deep-sea cores, mineral abundances, Atlantic Ocean: Rex, R. W. 01354
Montmorillonite, fixation of hydroxy-aluminum: Gupta, G. C. 08494
Montmorillonite, swelling in water-organic mixtures: Brindley, G. W. 08495
Mowry Shale, Wyoming: Davis, John Clements. 01129
Phillipsite, synthetic: Kühl, G. H. 08492
Sediments, deep-sea, mineralogy: Rex, R. W. 08537
Methods
Deep-sea cores, mineral abundances: Rex, R. W. 01354
X-ray radiography
Data
Barrier island facies, Georgia, Sapelo Island: Howard, James D. 08447
Methods
Micropaleontology, black shale: Peters, Walter G. 01096
Yukon
Geomorphology
Blow River delta, morphology, sedimentation: McCloy, James Murl. 01184
Glacial geology
Snag-Klutlan area, Pleistocene history: Rampton, Vernon Neil. 01242
Zinc
Oregon
Occurrence, potential: Bowen, R. G. 08731

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